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National Dioxin Study
Tier 4 - Combustion Sources
Final Literature Review

Radian Corp., Research Triangle Park, NC

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16. ABSTRACT

The objective of Tier 4 of the National Dioxin Study is to determine if combustion sources emit significant amounts of chloronated dibenzo-p-dioxins (CDD) and chloronated dibenzofurans (CDF) to the atmosphere. An initial literature review was conducted during 1984 and published in October 1984 as "National Dioxin Study Tier 4 - Combustion Sources, Initial Literature Review and Testing Options", EPA-450/4-84-014b. The purpose of this report is to update the initial literature review. This document includes CDD/CDF emissions information available through July 1985.

A tabular summary of the CDD/CDF emissions data base and a reference list of 250 citations are included.

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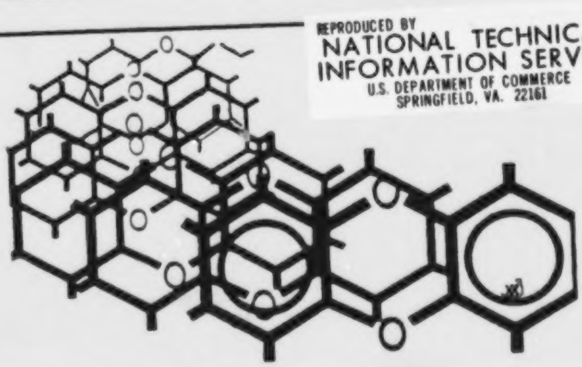

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National Dioxin Study Tier 4 — Combustion Sources

Final Literature Review

By
Radian Corporation
Research Triangle Park, NC 27709

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CHAPTER 1
EXECUTIVE SUMMARY

The Air Management Technology Branch of EPA's Office of Air Quality Planning and Standards (OAQPS) was responsible for implementing Tier 4 of the National Dioxin Study. Radian Corporation, under task order contract, provided technical support for this program. The technical support included developing literature surveys, preparing sampling protocols, conducting stack tests, coordinating ash sampling efforts and preparing this and other reports.

The National Dioxin Study was focused on the study of chlorinated dibenzo-p-dioxins (CDD's), and in particular on polychlorinated dibenzo-p-dioxins containing four or more chlorine atoms (PCDD's). The acronyms CDD and PCDD will be used in this report to denote these species. Chapter 2 contains a complete explanation of the nomenclature used in this report.

The Tier 4 study began in November 1983 with an extensive literature survey. The purpose of the literature survey was to 1) summarize previous research done on emissions of CDD's and chlorinated dibenzofurans (CDF's) from combustion processes, and 2) summarize available CDD and CDF emissions data from combustion processes. This report is a final update of the initial literature review and includes CDD/CDF emissions information available in the literature through July of 1985.

The literature survey identified 13 broadly defined source categories for which some PCDD and polychlorinated dibenzofuran (PCDF) emissions data was available. These are shown in Table 1-1. The literature survey indicated that municipal solid waste incinerators were the most frequently tested source category and had the highest levels of PCDD's and PCDF's in stack gas emissions. Commercial boilers co-firing spiked waste oil had the next highest PCDD concentrations in stack gas emissions, followed by emissions from one tested unit combusting pentachlorophenol-treated wood.

PCDD's and PCDF's were not found in stack emissions from all combustion sources for which data were reported in the literature. Two utility boilers

TABLE 1-1. SUMMARY OF PCDD/PCDF STACK EMISSIONS FROM THE LITERATURE BY SOURCE CATEGORY

Source Category	Number of Units Tested	Range of PCDD Emissions (ng/m^3)	Range of PCDF Emissions (ng/m^3)
Municipal Waste Incinerators			
European	8	71 - 48,997	37 - 9,831
U.S. and Canada	10	3.3 - 11,686	8.5 - 22,000
Boilers Cofiring Waste			
Commercial	3	1,400 - 17,000	170
Industrial	5	<0.002[a] - 76.4	<0.002 - 5.5
Wood Combustion			
PCP-Treated Wood	2	<17[b] - 1,520	<17[b] - 587
Sewage Sludge Incinerators	2	812	1,374
Hospital Incinerators	4	15 - 69	25 - 156
Hazardous Waste Incinerators			
Rotary Kiln	2	7.7 - 8.6	11.2 - 19
Carbon Regeneration Furnace			
without Afterburner	1	0.18	0.3
with Afterburner	1	1.58	0.05
Cement Kilns	3	<1[c] - 1.35	<1[c] - 0.74
Lime Kilns	1	<0.34 - <2.0	---
Utility Boiler Cofiring Waste	1	<0.031 - <0.10	<0.31 - <0.10
Fossil Fuel Combustion			
Coal-Fired Utility	4	<0.10 - <0.70	<0.10 - <0.70
Pulverized Coal	1	<4.2 - <7.9[d]	<0.67 - <1.3[d]
Oil-Fired Utility	1	<4.2 - <7.9[d]	<0.67 - <1.3[d]
Incinerator Ship	1	<0.0009 - <0.086[e]	<0.3 - <3.0

"---" means data not reported.

[a] Numbers preceded by "<" indicate detection limits.

[b] Detection limits reported in terms of ppb (by volume).

[c] Detection limits reported in terms of ng/ul of sample injected into GC-MS for analysis.

[d] 2378 TCDD/2378 TCDF scan only.

[e] Detection limits reported in terms of ng/ml injected into GC-MS for analysis.

firing PCB-spiked waste oil, a lime kiln, a coal-fired utility boiler and the incinerator ship M/T Vulcanus were all tested and had less than detectable PCDD emissions. In general, the literature survey showed that where combustion sources did emit PCDD's or PCDF's, these emissions appear to be dependent on the types of fuel or waste being fired and whether or not the combustion units were designed and operated specifically to achieve the destruction of compounds such as PCDD's and PCDF's.

Emissions from combustion devices burning clean fuel such as natural gas and distillate oil have not been adequately characterized. However, these sources are unlikely to emit high levels of PCDD/PCDF's because of the low levels of precursors, specifically chlorine, present in the fuel. Some high temperature (above 2,500°F firebox temperature) combustion sources such as utility boilers and cement kilns were also found to emit less than detectable amounts of PCDD/PCDF under the test conditions.

Based on the literature review, several factors are believed to affect CDD/CDF emissions. These factors include the PCDD content of the feed, precursor content of the feed, chlorine content of the feed, combustion device temperature, combustion device residence time, combustion device oxygen availability, feed processing and supplemental fuel.

CHAPTER 2

BACKGROUND

A literature review for sources of PCDD and PCDF air emissions was made in 1983 by the Pollutant Assessment Branch (OAQPS/PAB) of the United States Environmental Protection Agency (EPA).[a] This review was used as a starting point for a more focused literature search concerning PCDD emissions from combustion sources in early 1984. The 1984 literature review identified sources of PCDD and PCDF air emissions and provided the data base on which the Tier 4 testing program was developed.[b] At the conclusion of the source testing efforts, a final update of this review was conducted to include CDD/CDF emissions information available through July of 1985.

This chapter summarizes the final literature review. Industrial, commercial, and residential combustion sources that have been tested for CDD/CDF emissions are identified. Quantitative data are presented on emissions of 2378-TCDD, PCDD's, and PCDF's. Qualitative information on the source characteristics, feed composition, and sampling and analytical methodologies are also presented.

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[a] Brooks, G. W. Summary of a Literature Search to Develop Information on Sources of Chlorinated Dioxin and Furan Air Emissions. Final Report. Contract No. 68-02-3513. U. S. Environmental Protection Agency, October 1983.

[b] (Radian Corporation) National Dioxin Study--Tier 4 Combustion Sources. Initial Literature Review and Testing Options. EPA-450/4-84-014B. October 1984.

2.1 BACKGROUND INFORMATION ON CHLORINATED DIBENZO-p-DIOXINS AND CHLORINATED DIBENZOFURANS

2.1.1 Structure

Compounds which are generally labeled by the public as "dioxins" are members of a family of organic compounds known chemically as dibenzo-p-dioxins. The common aspect of all dibenzo-p-dioxin compounds is that they have a three ring nucleus consisting of two benzene rings interconnected by a pair of oxygen atoms. The structural formula of the dioxin nucleus and the convention used in numbering its substituent positions are shown in Figure 2-1a. In general, the term "dioxins" is used to mean the chlorinated isomers of dibenzo-p-dioxin. Theoretically, one to eight chlorine atoms can occur at dioxin substituent positions such that 75 chlorinated dioxin isomers are possible. Each isomer has its own physical and chemical properties and differs from others in the number and relative position of its chlorine atoms. The potential chlorinated dioxin isomers are listed in Table 2-1.

One of the 22 isomers with four chlorine atoms is 2,3,7,8-tetrachlorodibenzo-p-dioxin (2378-TCDD). This isomer is the principal focus of the Tier 4 study for three reasons:

1. 2378-TCDD is believed to be the most toxic of the chlorinated dioxins,
2. 2378-TCDD is the isomer most often associated with exposure and potential health risks to humans, and
3. sufficient associated health and exposure information is available on 2378-TCDD to allow a targeted study to be developed.

The compounds generally referred to as "furans" are members of a family of organic compounds known chemically as dibenzofurans. They have a similar structure to the dibenzo-p-dioxins except that the two benzene rings in the nucleus are interconnected with a five member ring containing only one oxygen atom. The structural formula of the furan nucleus and the convention used in numbering its substituent positions are shown in Figure 2-1b. Theoretically, the chlorinated furan group can contain up to 135 different structural

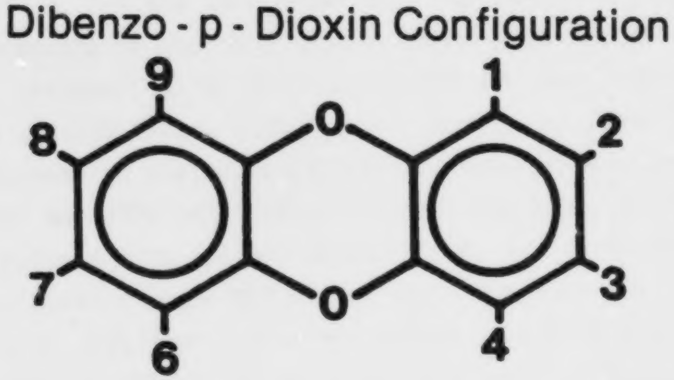
Dibenzo - p - Dioxin Configuration
9
1
8
2
O
O
7
3
6
4

Figure 2-1a. Structural Formula of the Dioxin Nucleus

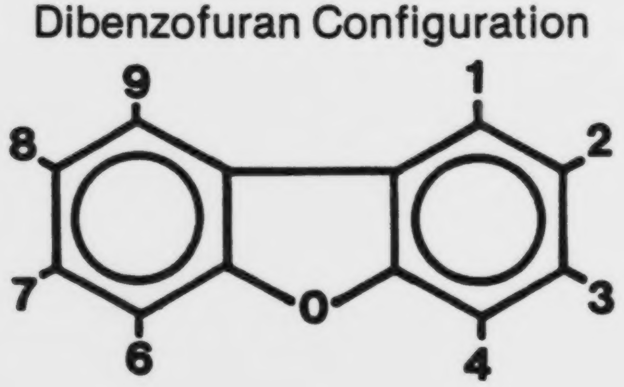
Dibenzofuran Configuration
9
1
8
2
O
7
3
6
4

Figure 2-1b. Structural Formula of the Furan Nucleus

isomers, each with varying physical and chemical properties. The potential chlorinated furan isomers are listed in Table 2-2.

2.1.2 Nomenclature Used in This Report

Throughout this document the terms CDD and CDF will be used to generically indicate chlorinated dibenzo-p-dioxin or dibenzofuran compounds as distinguished from specific chlorinated CDD or CDF isomers. The abbreviations PCDD and PCDF are used to indicate polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) with four or more chlorine atoms. In the discussion of emissions data the terms total PCDD and total PCDF represent the sum of the emissions of the tetra through octa homologues. The term "other TCDD's" represents the sum of all CDD isomers containing four chlorine atoms except the 2378-TCDD isomer for which available emissions data are described separately. The term "chlorinated CDD/CDF homologue" will be used to indicate the family of CDD/CDF isomers with a fixed number of chlorine atoms. For example, the tetra chlorinated CDD homologue consists of all CDD isomers containing four chlorine atoms. The abbreviations used for chlorinated CDD/CDF homologues are included in Tables 2-1 and 2-2.

Table 2-1. Nomenclature and Schedule of Theoretical Chlorinated Dioxin Isomers

Chlorinated Dioxin Compound (abbreviation)	No. of Isomers
Monochlorodibenzo-p-dioxin (Mono-CDD)	2
Dichlorodibenzo-p-dioxin (Di-CDD)	10
Trichlorodibenzo-p-dioxin (Tri-CDD)	14
Tetrachlorodibenzo-p-dioxin (TCDD)	22
Pentachlorodibenzo-p-dioxin (Penta-CDD)	14
Hexachlorodibenzo-p-dioxin (Hexa-CDD)	10
Heptachlorodibenzo-p-dioxin (Hepta-CDD)	2
Octachlorodibenzo-p-dioxin (Octa-CDD)	1
TOTAL ISOMERS	75

Table 2-2. Nomenclature and Schedule of Theoretical Chlorinated Furan Isomers

Chlorinated Furan Compound (abbreviation)	No. of Isomers
Monochlorodibenzofuran (Mono-CDF)	4
Dichlorodibenzofuran (Di-CDF)	16
Trichlorodibenzofuran (Tri-CDF)	28
Tetrachlorodibenzofuran (TCDF)	38
Pentachlorodibenzofuran (Penta-CDF)	28
Hexachlorodibenzofuran (Hexa-CDF)	16
Heptachlorodibenzofuran (Hepta-CDF)	4
Octachlorodibenzofuran (Octa-CDF)	1
TOTAL ISOMERS	135

CHAPTER 3
LITERATURE REVIEW

This chapter summarizes the final literature review. Industrial, commercial, and residential combustion sources that have been tested for CDD/CDF emissions are identified. Quantitative data are presented on emissions of 2378-TCDD, PCDD's, and PCDF's. Qualitative information on the source characteristics, feed composition, and sampling and analytical methodologies are also presented.

Sections 3.1 and 3.2 present a summary of the literature review. Emissions data are presented for 2378-TCDD, PCDD, and PCDF, along with qualitative information on source characteristics. CDD/CDF formation hypotheses are summarized in Section 3.3. Section 3.4 presents a discussion of factors affecting CDD emissions. Complete listings of CDD emissions data available from the literature are provided in Appendix B.

3.1 OVERVIEW OF THE LITERATURE DATA BASE

A review of the literature identified thirteen broadly defined source categories for which some PCDD and PCDF emissions data have been collected:

- municipal solid waste incinerators,
- sewage sludge incinerators,
- fossil fuel combustion,
- wood combustion,
- boilers co-firing wastes,
- hazardous waste incinerators,
- hospital incinerators,
- lime/cement kilns,
- wire reclamation incinerators,
- PCB fires,
- automobile emissions,

- activated carbon regeneration furnaces, and
- experimental studies.

The PCDD and PCDF emissions data for each source category are presented in the following sections. The primary purpose of this presentation is to identify combustion sources that emit PCDD's and PCDF's and, as a result of comparisons of emissions and source characteristics, to identify combustion sources that are unlikely to emit PCDD's and PCDF's. A positive finding in the literature (i.e., detectable CDD emissions) may suggest the tested combustion source emits CDD, but this conclusion can only be reached after consideration of the quality of the reported data or research. Likewise, a negative finding in the literature (i.e., less than detectable CDD emissions) may be misleading if high detection limits or inappropriate sampling and analysis methods were used. Direct comparison of data reported in the literature by different researchers is difficult and should be done with caution for several reasons. The data are often reported on different bases which cannot easily be interconverted because of the lack of source-specific information. Different sampling and analytical procedures were often used, and detection limits are frequently not specified. Facility design and operation may vary considerably and this type of information is often incompletely reported. Also, some data are available from draft reports, emission tests, and other unpublished documents which have not been subjected to peer or editorial review. For this reason, analysis or full explanation of the literature data is not possible. However, for the purpose of the Tier 4 Study, broad generalizations can be drawn. In the following sections, emission test results are presented separately for each study along with appropriate tables. If available, information is provided in the text about the combustion unit, analysis of feed samples, or identification of precursors present in the feed materials. When available, detection limits are specified. If analytical methods other than gas chromatography-mass spectrometry (GC-MS) were used, that information is noted in the text.

3.1.1 Summary of Stack PCDD and PCDF Emissions

Table 3-1 presents a summary of stack PCDD and PCDF emissions data available from the literature for combustion sources. The data for each

TABLE 3-1. SUMMARY OF PCDD/PCDF STACK EMISSIONS DATA FROM THE LITERATURE^{a,b,c}

Source Category [Total # Tested]	Sample Type	2378 TCDD (ng/m^3)		PCDD (ng/m^3)		PCDF (ng/m^3)		Reference/Comments
		Detected Range	Detection Limits	Detected Range	Detection Limits	Detected Range	Detection Limits	
Municipal Waste Incinerators								
o European [8]	FG	-	-	71-48,997 (8)	-	37-9,831 (8)	-	43, 87, 109
o U.S. and Canada [10]	FG	0.2-95 (6)	-	3.3-11,686 (10)	-	8.5-22,000 (9)	-	32, 49, 92, 101, 168, 174, 181, 196, 205
Boilers Cofiring Wastes								
o Commercial [3]	FG	-	-	1,400-17,000 (3)	NA^e (3)	170 (1)	NA (2)	81: o Boilers cofiring spiked waste oil. o PCDD refers to only TCDD and OCDD in this reference.
o Industrial [5]	FG	0.002 (1)	<0.002-1.5 (1)	0.64-76.4 (5)	<0.002-1,000 (4)	0.15-5.5 (3)	<0.002-1,000 (4)	40, 41: o Highest PCDD levels from 2 boilers firing creosote sludge. Creosote sludge feed for 1 boiler was contaminated with PCDD's.
o Utility [1]	FG	ND	<0.031-0.10 (1)	ND	<0.031-0.10 (1)	ND	<0.031-0.10 (1)	96: o PCB-spiked waste oil feed.
Wood Combustion								
o PCP-Treated Wood [2]	FG	-	-	1,520 (1)	<17ppb (1)	587 (1)	<17ppb (1)	220, 233: o The one unit with less than detectable emissions was designed to incinerate PCP-treated wood; the other unit was not. o Detection limits reported in terms of v/v.

(continued)

TABLE 3-1. (CONTINUED) SUMMARY OF PCDD/PCDF STACK EMISSIONS DATA FROM THE LITERATURE^{a,b,c}

Source Category [Total # Tested]	Sample Type	2378 TCDD (ng/m^3)		PCDD (ng/m^3)		PCDF (ng/m^3)		Reference/Comments
		Detected Range	Detection Limits	Detected Range	Detection Limits	Detected Range	Detection Limits	
Sewage Sludge Incinerators [2]	FG	-	-	812 (1)	NA (1)	1,374 (1)	NA (1)	24, 235: o In Ref. 235, results reported as "dioxins" and "furans" assumed to be PCDD/PCDF. o In Ref. 24, "fumes" were trapped with water condenser.
Hospital Incinerators [4]	FG	-	-	15-69 (4)	-	25-156 (4)	-	31a, 62a
Hazardous Waste Incinerators								
o Rotary Kiln [2]	FG	-	-	7.7-8.6 (2)	-	11.2-19 (2)	-	88, 153a: o Fuels were Silvex herbicide (88) and chlorophenolic wastes (153a).
Activated Carbon Regeneration								
o w/o Afterburner [1]	FG	0.1 (1)	-	0.18 (1)	-	0.3 (1)	-	13: o Fluidized bed combustion before installation of afterburner.
o w/ Afterburner [1]	FG	-	-	1.58 (1)	-	0.05 (1)	-	156: o Fluidized bed combustion after installation of afterburner. o PCDD means only H7CDD and OCDD homologs. o PCDF means only H6CDF, H7CDF, OCDF homologs.

(continued)

TABLE 3-1. (CONTINUED) SUMMARY OF PCDD/PCDF STACK EMISSIONS DATA FROM THE LITERATURE[a,b,c]

		2378 TCDD (ng/m^3)		PCDD (ng/m^3)		PCDF (ng/m^3)		
Source Category [Total # Tested]	Sample Type	Detected Range	Detection Limits	Detected Range	Detection Limits	Detected Range	Detection Limits	Reference/Comments
Cement Kilns [3]	FG	-	-	1.35 (1)	<1 ng/ul (2)	0.74 (1)	<1 ng/ul (2)	20a, 20b, 184: o In one of four SASS trains, H7CDD and H7CDF homologs detected only (Ref. 184). o Detectable emissions occurred during upset combustion conditions. o Detection limits expressed in terms of ng/ul injected into GC-MS.
Lime Kilns [1]	FG	-	-	ND	<0.34-2.0 (1)	-	-	58a
Fossil Fuel Boilers								
o Coal-fired Utility [4]	FG	-	-	ND	<0.10-0.70 (4)	-	<0.10-0.70 (4)	94
o Pulverized Coal [1]	FG	ND	<4.2-7.9 (1)	-	-	-	<0.67-1.3 (1)	5: o 2378 TCDD/F scan only.
o Oil-fired Utility [1]	FG	ND	<4.2-7.9 (1)	-	-	-	<0.67-1.3 (1)	5: o 2378 TCDD/F scan only.

(continued)

TABLE 3-1. (CONTINUED) SUMMARY OF PCDD/PCDF STACK EMISSIONS DATA FROM THE LITERATURE[a,b,c]

Source Category [Total # Tested]	Sample Type	2378 TCDD (ng/m^3) Detected Range	2378 TCDD (ng/m^3) Detection Limits	PCDD (ng/m^3) Detected Range	PCDD (ng/m^3) Detection Limits	PCDF (ng/m^3) Detected Range	PCDF (ng/m^3) Detection Limits	Reference/Comments
Incinerator Ships								
o M/T Vulcanus [1]	FG	-	-	ND	<0.0009-0.086 ng/ml (1)	-	-	1: o TCDD scan only. o Fuel was Herbicide Orange. o Detection limits expressed in terms of ng/ml injected into GC-MS.
o M/T Vulcanus [1]	FG	ND	NA (1)	ND	NA (1)	-	<0.3-3 (1)	2: o TCDD/TCDF scans only. o Feed samples were contaminated with PCDF's. o Feed was PCB's.

"-" means no data were available because analysis was not done or data were not reported.

[a] Detected Range is range of average levels detected. If only one value is shown it represents the average value of all tests for one unit. The number of sources having detectable emissions is shown in parentheses under the range values.

[b] Detection limits are shown when a source had less than detectable emissions. The number of sources having less than detectable emissions is shown in parentheses under the detection limits.

[c] The number in parentheses below each range represents the number of units having detectable or less than detectable emissions.

[e] NA = Not Available

[d] ND = Not Detected

FG = Flue Gas

source category are discussed in detail in Section 3.2. For each source category the total number of facilities tested is shown, as is the type of sample. The ranges of detected emissions and detection limits are shown for the 2378-TCDD isomer, PCDD's, and PCDF's. The column labeled "Detected Range" represents the range of average concentrations reported by different literature references. If only one value is shown it represents the average value of all tests for one unit. The number of sources having detectable emissions is shown in parentheses under the range values. Detection limits are shown in the column labeled "Detection Limits" when a source had less than detectable PCDD or PCDF emissions. The number of sources having less than detectable emissions is shown in parentheses under the detection limits. Comments are provided if the results were affected by such things as contaminated fuel, upset operating conditions, or use of a nonspecific analytical technique. In the table, the source categories are ordered by the highest value of the PCDD emissions range.

PCDD's and PCDF's were not found in stack emissions from all combustion sources. Utility boilers firing PCB-spiked waste oil, a lime kiln, a coal-fired utility boiler, and the incinerator ship M/T Vulcanus had less than detectable PCDD and (if analyzed for) PCDF emissions.

In general, where combustion sources did emit PCDD's or PCDF's, these emissions appeared to be dependent on the types of fuel or wastes being fired, and whether or not the combustion unit was designed and operated specifically to achieve the destruction of potentially hazardous wastes including PCDD's and PCDF's. However, sampling and analysis methods and facility design and operation may vary considerably between studies, which makes direct comparisons of emissions test data difficult. For most of the sources tested, the magnitude of PCDD emissions was comparable to the magnitude of PCDF emissions. Most of the studies analyzed samples for PCDD's; some studies quantitated 2378-TCDD and the PCDF homologues as well. Samples were taken primarily at the stack outlet location and not at the control device inlet. The range of measured PCDD and PCDF concentrations varies from one to four orders of magnitude.

Municipal solid waste incinerators were the most frequently tested source and had the highest levels of PCDD's and PCDF's in stack gas emissions. Facilities located in Europe had higher PCDD emissions than North American facilities. Commercial boilers co-firing spiked waste oil had the next highest PCDD concentration in stack gas emissions, followed by emissions from one tested unit combusting PCP-treated wood. However, another combustion unit designed to incinerate PCP-treated wood had less than detectable PCDD or PCDF emissions. Of the remaining source categories tested, sewage sludge incinerators, hospital incinerators, and two rotary kiln hazardous waste incinerators had the next highest PCDD emissions, respectively.

Emissions data for the 2378-TCDD isomer were available for five source categories. Municipal waste incinerators had the highest stack emissions of 2378-TCDD, followed by a fluidized bed system used to regenerate activated carbon, and an industrial boiler. One coal-fired utility boiler and the incinerator ship M/T Vulcanus had nondetectable levels of the 2378-TCDD isomer.

3.1.2 Summary of Ash PCDD and PCDF Emissions

Table 3-2 presents a summary of data on the PCDD and PCDF content of combustion ash samples available in the literature. The data for each source category are discussed in detail in Section 3.2. As in Table 3-1, Table 3-2 shows the number of facilities tested and the type of sample. The range of detected emissions and detection limits for the 2378-TCDD isomer, PCDD's and PCDF's are also shown for each source category. The source categories are ordered by the highest value of the PCDD range for each category.

PCDD's and PCDF's were not found in ash samples from all combustion sources. Three rotary kilns, thirteen coal-fired boilers, two diesel cars, a lime kiln, and a sewage sludge incinerator had less than detectable levels of PCDD's or PCDF's (if analyzed for) in ash or particulate samples.

A rotary kiln operated without supplemental fuel fired in the afterburner had the highest PCDD concentration in particulate samples. However, these results were skewed high by the use of a nonspecific GC-MS packed column analytical method. The same rotary kiln operated with

TABLE 3-2. SUMMARY OF LITERATURE DATA ON PCDD AND PCDF CONTENTS OF COMBUSTION ASH[a,b,c]

Source Category [Total # Tested]	Sample Type	2378 TCDD (ng/g) Detected Range	2378 TCDD (ng/g) Detection Limits	PCDD (ng/g) Detected Range	PCDD (ng/g) Detection Limits	PCDF (ng/g) Detected Range	PCDF (ng/g) Detection Limits	Reference/Comments
Hazardous Waste Incinerators								
o Rotary Kiln [1] w/o Supplemental Fuel	Part.	1,870 (1)	-	323,570 (1)	-	-	-	62: o Results skewed high by nonspecific analytical method used for one of three test runs. o No supplemental fuel fired in afterburner.
o Rotary Kiln [1] w/Supplemental Fuel	Part	ND[d]	<2-5 (1)	267 (1)	-	-	-	62: o Supplemental fuel fired in afterburner.
o Tar Burner [1]	Part.	ND	<1.3-3 (1)	406 (1)	-	-	-	62
o Mobile Incinerator [1]	Ash	-	-	91.3 ng (1)	-	-	-	108: o OCDD homolog only, suspected contaminant. Leakage of samples prevented concentration calculation.
o Rotary Kiln [3]	Part.	-	-	ND	NA[e] (3)	ND	NA (2)	161

(continued)

TABLE 3-2. (CONTINUED) SUMMARY OF PCDD/PCDF ASH EMISSIONS DATA FROM THE LITERATURE[a,b,c]

Source Category [Total # Tested]	Sample Type	2378 TCDD (ng/g) Detected Range	2378 TCDD (ng/g) Detection Limits	PCDD (ng/g) Detected Range	PCDD (ng/g) Detection Limits	PCDF (ng/g) Detected Range	PCDF (ng/g) Detection Limits	Reference/Comments
PCB Transformer Fires [8]	Soot	59-600 (2)	-	324-19,400 (2)	<10-100 (2)	1,710-2,160,000 (4)	-	60, 99, 158: o 2 transformer fires with high PCDF levels had less than detectable levels of PCDD.
	Wipes	-	-	-	-	772-10,900 ng/m^2 (2)	-	76, 192: o Results reported in terms of surface area.
	Liquid	-	-	-	-	75,000 (1)	-	110: o Liquid from inside exploded capacitor.
	Ash	-	-	5.2 (1)	-	41.4 (1)	-	218: o Only H7CDD and OCDD homologs detected.
Municipal Waste Incinerator								
o European [31]	FA	-	-	0.2-3537 (29)	NA (2)	1.93-1,770 (17)	-	12, 25, 26, 33, 43, 71, 116, 118, 143, 144, 178
o U.S. and Canada [14]	FA	5.2 (1)	-	6.2-2,300 (14)	-	10-3,100 (12)	-	47, 49, 69, 90, 92, 168, 181, 203, 222
o Japanese [2]	FA	-	-	2.4-4.8 (2)	-	-	-	71

(continued)

TABLE 3-2. (CONTINUED) SUMMARY OF PCDD/PCDF ASH EMISSIONS DATA FROM THE LITERATURE^{a,b,c}

Source Category [Total # Tested]	Sample Type	2378 TCDD (ng/g) Detected Range	2378 TCDD (ng/g) Detection Limits	PCDD (ng/g) Detected Range	PCDD (ng/g) Detection Limits	PCDF (ng/g) Detected Range	PCDF (ng/g) Detection Limits	Reference/Comments
Fossil Fuel								
o Natural Gas [1]	FA	0.6 (1)	-	1,764 (1)	-	-	-	62: o H6CDD, H7CDD, and OCDD homologs only. Analyses by GC-EC.
o Coal and Oil [1]	Part.	-	-	68 (1)	-	-	-	62: o Feed may have had high chlorine content or contamination. o P5CDD not analyzed for.
o Coal [13]	FA	-	-	ND	<0.0006-0.07 (13)	ND	<0.01-0.07 (1)	59, 94, 97, 125
Boilers Cofiring Wastes								
o Commercial Boiler [1]	FA	-	-	911 (1)	-	3,777 (1)	-	81: o Cofiring used automobile oil spiked with organic compounds. o No TCDD's detected, only penta through octa homologs.
o Industrial Boiler [1]	FA	-	-	600 (1)	-	300 (1)	-	33: o Cofiring used industrial oils.
Hospital Incinerator [1]	FA	-	-	259 (1)	-	265 (1)	-	31a

(continued)

TABLE 3-2. (CONTINUED) SUMMARY OF PCDD/PCDF ASH EMISSIONS DATA FROM THE LITERATURE[a,b,c]

Source Category [Total # Tested]	Sample Type	2378 TCDD (ng/g) Detected Range	2378 TCDD (ng/g) Detection Limits	PCDD (ng/g) Detected Range	PCDD (ng/g) Detection Limits	PCDF (ng/g) Detected Range	PCDF (ng/g) Detection Limits	Reference/Comments
Wood Combustion								
o Residential Woodstoves [24]	Ash	0.001-0.20 (15)	<0.0009-0.0014 (2)	0.007-210 (24)	-	-	-	54, 62, 165, 167: o Some fuel may have been contaminated.
Activated Carbon Regeneration								
o w/o Afterburner [1]	Part.	25 (1)	-	48 (1)	-	103 (1)	-	13: o TCDD/TCDF scan only. o Fluidized bed combustion prior to installation of afterburner.
Automobile Emissions								
o Leaded gas [3]	Filter Extract	2.98 (3)	-	47.7 (3)	-	-	-	213: o One composite sample from 3 vehicles analyzed.
o Unleaded gas [10]	Filter Extract	1.4 (10)	-	37.4 (10)	-	-	-	213: o One composite sample from 10 vehicles analyzed.
o Diesel Truck [2]	Scraping	ND	<0.003 (2)	0.39-0.40 (2)	-	-	-	62
o Unleaded gas [2]	Scraping	ND	<0.0002 (2)	0.01-0.08 (2)	-	-	-	62
o Leaded gas [1]	Scraping	ND	<0.002 (1)	0.004 (1)	-	-	-	62
o Diesel Car [2]	Filter Extract	ND	<0.04 ng/sample (2)	ND	<0.04 ng/sample (2)	-	-	213 o TCDD scan only.

(continued)

TABLE 3-2. (CONTINUED) SUMMARY OF PCDD/PCDF ASH EMISSIONS DATA FROM THE LITERATURE[a,b,c]

		2378 TCDD (ng/g)		PCDD (ng/g)		PCDF (ng/g)		
Source Category [Total # Tested]	Sample Type	Detected Range	Detection Limits	Detected Range	Detection Limits	Detected Range	Detection Limits	Reference/Comments
Wire Reclamation [1]	FA	-	-	0.41 (1)	-	11.6 (1)	-	103: o TCDD/TCDF scan only.
Cement Kiln [1]	Part.	-	-	-	-	44.8 (1)	-	184: o One of four Method 5 filters contained P5CDF, HCDF, and H7CDF. o Detectable emissions occurred during upset operating conditions.
Lime Kiln [1]	Baghouse dust	-	-	ND	<0.005-0.25 (1)	-	-	58a
Sewage Sludge Incineration								
	FA	-	-	ND	NA (1)	-	-	24: o Fly ash collected by dust abatement.
	Ashes	-	-	ND	NA (1)	-	-	24

"—" means no data were available because analysis was not done.

FA = Fly Ash; Part. = Particulate phase of gaseous sample; Filter Extract = Particulate Filter Extract; Scraping = Muffler Exhaust Scraping

[a] Detected range is range of average levels detected. If only one value is shown it represents the average value of all tests for one unit. The number of sources having detectable emissions is shown in parentheses under the range values.

[b] Detection limits are shown when a source had less than detectable emissions. The number of sources having less than detectable emissions is shown in parentheses under the detection limits.

[c] The number in parentheses is number of units having detectable or less than detectable emissions.

[d] ND = Not Detected

[e] NA = Not Available

supplemental fuel had significantly lower PCDD levels in particulate samples. PCB fires had the second highest PCDD concentration in soot samples, and also had the highest PCDF levels. Unlike flue gas samples, the level of PCDD's found in ash samples were less than PCDF levels for most of the combustion sources where both PCDD's and PCDF's were analyzed for. Municipal waste incinerators had the next highest concentrations of PCDD's in ash samples. In general, European facilities had higher levels of PCDD's than North American or Japanese facilities. However, two European facilities had less than detectable PCDD's in ash samples. North American facilities had higher PCDF levels in ash samples than European facilities. A natural gas-fired residential heater had the next highest PCDD levels in fly ash emissions, followed by a commercial boiler co-firing used automobile oil spiked with organic compounds, and a hospital incinerator. Residential woodstoves had detectable levels of PCDD's in ash samples, but some of the fuel was reported to have been potentially contaminated. Other source categories having detectable levels of PCDD's or PCDF's in particulate or ash samples were activated carbon regeneration, automobile emissions, wire reclamation, and a cement kiln.

Concentration data for the 2378-TCDD isomer were available for ash and soot taken from seven source categories. A rotary kiln burning tars, solid waste, and natural gas and operated without supplemental fuel being fired in the afterburner had the highest concentration of 2378-TCDD in particulate samples. However, the same rotary kiln had less than detectable emissions of 2378-TCDD when supplemental fuel (tars and natural gas) was fired in the afterburner. PCB fires had the second highest concentration of 2378-TCDD in soot samples followed by a fluidized bed combustion system used to regenerate activated carbon. Municipal waste incinerators had the next highest detectable levels of 2378-TCDD in fly ash samples, followed by filter extract samples from vehicles burning leaded and unleaded gasoline. Other sources having detectable levels of 2378-TCDD were a natural gas-fired residential heater and residential woodstoves. Particulate matter samples from a tar burner had less than detectable levels of 2378-TCDD.

3.2 EMISSIONS DATA FOR INDIVIDUAL SOURCE CATEGORIES

In this section, the available PCDD/PCDF emissions data for individual source categories are discussed. Sections 3.2.1 through 3.2.12 cover municipal solid waste incinerators, sewage sludge incinerators, fossil fuel combustion, wood combustion, boilers co-firing wastes, hazardous waste incinerators, lime/cement kilns, hospital incinerators, wire reclamation incinerators, PCB fires, automobile emissions, and activated carbon regeneration furnaces, respectively. Various experimental studies are discussed in Section 3.2.13.

3.2.1 Municipal Solid Waste Incinerators

Table 3-3 presents the emissions data for municipal solid waste incinerators.

In 1978, TCDD's were detected in the emissions from the Hempstead municipal waste incinerator (MWI) on Long Island. Since that date, this source category has received considerable attention in the United States. The Canadian Government has identified MWI's as one of the major combustion sources of PCDD's in the Canadian environment.[73] Numerous tests have also been conducted in Europe and Japan.

MWI's can be classified as either large mass burn units, refuse derived fuel (RDF) units, or small modular units. There are approximately 43 facilities with modular units, 45 mass burn facilities and 8 RDF boiler facilities currently operating in the United States and Canada.[a] The mass burn facilities are responsible for the majority of waste burned.

This section summarizes the PCDD and PCDF flue gas emissions and fly ash content data for MWI's operating in North America (including Canada), Europe and Japan. It is based upon a review of the available literature that reports emissions studies of CDD and CDF emissions from MWI's. Thirtyeight articles were reviewed and approximately 70 percent of the emission studies were found in various journal articles and from reports published by government and state environmental agencies.

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[a] Resource Recovery Activities, City Currents. April 1985.

TABLE 3-3. SOURCE CATEGORY: MUNICIPAL SOLID WASTE INCINERATORS

Type of Facility	No. of Units Tested (Location)	Sample	PCDD/PCDF Emission Concentration and Ash Sample Content						References
			2378-TCDD		PCDD		PCDF		
			Mean	Range	Mean	Range	Mean	Range	
MSW INCINERATORS:									
North America	10	FG	19.1 ng/m^3	0.2-95 ng/m^3	1,450 ng/m^3	3.3-11,686 ng/m^3	2,436 ng/m^3	8.5-22,000 ng/m^3	32,49,51 92, 101, 115, 168, 174, 18, 196, 205
	21	FA	2.98 ppb	0.48-6.6 ppb	362.7 ppb	<0.5-2,300 ppb	923 ppb	<0.5-3,100 ppb	47, 49, 69, 70, 71, 90, 92, 168, 181, 203, 222
European	8	FG	-	-	2,935 ng/m^3	48,997 ng/m3	2,398 ng/m^3	37-9,831 ng/m^3	43, 87, 109
	31	FA	-	-	588 ppb	<0.5-3537 ppb	288 ppb	ND[a]-1,770 ppb	12, 25, 26, 43, 71, 116, 118, 143, 144, 178
Japanese	2	FA	-	-	3.6 ppb	2.4-4.8 ppb	-	-	71

"—" means no data

FG = Flue Gas

FA = Fly Ash

[a] ND = Not Detected. Assumed to be zero in calculations.

Emissions data are available for 66 MWI facilities. Sixty-two are reported to utilize an electrostatic precipitator to control particulate matter emissions from flue gases. Twenty-nine of the facilities are located in the United States and Canada, 34 in Europe, and 3 in Japan.

3.2.1.1 United States and Canada. PCDD emissions from stack testing of 14 facilities located in North America ranged from not detected (ND) to 22,000 ng/m^3. PCDF stack emissions for 13 facilities ranged from ND to 15,060 ng/m^3. Detection limits were not specified. Both of these upper emission values were reported in an EPA study of a modular incinerator located in Langley, VA. It is characterized as being susceptible to upsets caused by grass clippings or because of wet refuse stored in an open pit.[92] Two facilities are known to emit low levels of PCDD's (35 to 146 ng/m^3) and PCDF's (50 to 246 ng/m^3). One is a modular unit equipped with a secondary chamber for combustion of off gases and the other uses RDF that is stored in a silo and is very dry when combusted.[49,174]

The PCDD content of fly ash samples from 24 MWI's ranged from <0.5 to 2,300 ppb. PCDF's from 13 facilities ranged from <0.5 to 3,100 ppb.

3.2.1.2 Europe. Flue gas emissions of PCDD's from eight MWI's located primarily in Italy ranged from ND to 48,900 ng/m^3. Flue gas emissions of PCDF's from seven facilities ranged from 37 to 7,460 ng/m^3. The highest PCDD and PCDF emissions were reported for six MWI's located in the Lombardy region of northern Italy.[43] The report contained no information describing feed composition, combustion design or operating conditions. However, each facility does utilize an ESP.

The PCDD content of fly ash samples from 31 facilities ranged from <0.5 to 3,540 ppb while PCDF's from 19 facilities ranged from ND to 1,770 ppb. Detection limits were not specified.

3.2.1.3 Japan. The PCDD content of fly ash samples from two facilities ranged from 2.4 to 4.8 ng/g.

3.2.2 Sewage Sludge Incinerators

Table 3-4 presents emissions data from two studies of sewage sludge incineration.[24,235] An unpublished study reported emissions from a single multiple hearth sludge incinerators with a water scrubber.[235] Operating

TABLE 3-4. SOURCE CATEGORY: SEWAGE SLUDGE INCINERATORS

Type of Facility	No. of Units Tested (Location)	Sample	PCDD/PCDF Emission Concentration and Ash Sample Content						References
			2378-TCDD		PCDD		PCDF		
			Mean	Range	Mean	Range	Mean	Range	
Multiple Hearth	1	FG	-	-	739 ng/m^3 ^{a} (3)	483-1,140 ng/m^3	1,213 ng/m^3 ^{a}	501-2,248 ng/m^3	235
Unspecified	1	Fumes^b	-	-	ND^c	-	-	-	24
		Ashes^b	-	-	ND	-	-	-	24

"—" means no data

[a] Reported in study as "dioxins" and "dibenzofurans."

[b] Samples are listed as reported in study.

[c] Not detected

temperatures were reported to be in excess of 1,000°C with a feed rate of 13 to 15.5 short tons/hour. The results were not reported in terms of specific homologues, only references to "CDD's" and "dibenzofurans" were made. For three sample periods flue gas samples contained "CDD's" ranging from 483 ng/m^3 to 1,140ng/m^3 with an average of 739 ng/m^3. "Dibenzofuran" concentrations in flue gas samples ranged from 501 ng/m^3 to 2,248 ng/m^3 with an average of 1,213 ng/m^3. No detection limits were specified for these unpublished results.

The second study[24] analyzed emissions from incineration of aerobic sludge. Fly ash was collected by means of "dust abatement", organic vapors were trapped with a water condenser, and ashes from the combustion process were collected by grab sample. The investigators reported PCDD's to be "absent" from both "ashes" and "fumes." Detection limits and information on the incinerator were not reported.

3.2.3 Fossil Fuel Combustion

Table 3-5 presents the emissions data from fossil fuel-fired combustion units.

3.2.3.1 Coal Combustion. Haile *et al.*[94] have reported results from research conducted as part of a nationwide study of organic emissions from utility coal combustion. Results were reported for four of the seven plants comprising the complete survey. Samples analyzed included samples from the flue gas outlet (downstream of the particulate emissions control device), fly ash emissions, and coal feed. PCDD and PCDF homologues were not identified in any sample from the four coal-fired plants. To maximize the method sensitivity, all samples were analyzed using five-day composites. Detection limits for PCDD and PCDF homologues in the flue gas analyses were 0.25 ng/m^3 for mono through tri-CDD; 0.10 ng/m^3 for tetra-CDD; 0.50 ng/m^3 for penta-CDD and hexa-CDD; and 0.70 ng/m^3 for hepta- and octa-CDD. For solid feed and fly ash samples, detection limits for the PCDD and PCDF homologues were .025 ng/g for mono- through tri-CDD; .010 ng/g for TCDD; .050 ng/g for penta- and hexa-CDD; and .070 ng/g for hepta and octa-CDD.

Harless and Lewis[97] tested fly ash samples from seven coal-fired power plants and found the samples had non-detectable levels of TCDD at an average

TABLE 3-5. SOURCE CATEGORY: FOSSIL FUEL COMBUSTION

Type of Facility	No. of Units Tested (Location)	Sample	PCDD/PCDF Emission Concentration and Ash Sample Content						References
			2378-TCDD		PCDD		PCDF		
			Mean	Range	Mean	Range	Mean	Range	
Utility Coal Boiler	4 USA	FG	-	-	ND[a]	-	ND	-	94
	4 USA	FA	-	-	ND	-	ND	-	94
Coal Boiler	7	FA	-	-	ND[b]	-	-	-	97
Coal Boiler	1	FA	-	-	ND[b]	-	-	-	59
Low Sulfur, High Ash Coal	1	FA	-	-	ND[b]	-	-	-	125
Pulverized Coal	1 Sweden	FG	ND	-	-	-	ND[c]	-	5
Coal and Oil	1 USA	Part.	ND	-	68 ng/g[e]	-	-	-	62
Coal and RDF	1 USA	FG	-	-	ND	-	ND	-	115,196
Oil-Fired, 250 MW Boiler	1 Sweden	FG	ND	-	-	-	ND[c]	-	5
Natural Gas, Residential Unit	1 USA	FA	0.6 ng/g	-	1764 ng/g[f]	-	-	-	62

" - " means no data

[a] not detected

[b] TCDD scan only

[c] Analysis for 2378 TCDF only

[d] Part.: stack particulate

[e] Penta-CDD not analyzed for

[f] Hexa-CDD, Hepta-CDD, and OCDD homologues only, analyzed for by GC-EC

detection limit of 0.002 ng/g. Also, in an unrelated study, DeRoos and Bjorseth[59] analyzed one fly ash sample collected from a coal-fired combustion unit for TCDD's. None were detected at a detection limit of 0.002 ng/g.

These results are in agreement with those reported by Kimble and Gross[125] who analyzed stack-collected fly ash from a typical commercial coal combustion facility burning a low sulfur, high ash coal. The chlorine content of the input coal was 50 ug/g and the sample was taken downstream from the electrostatic precipitator. At a detection limit of 0.0006 ng/g, TCDD's were not detected. Kimble and Gross conclude that a fossil-fueled power plant is not a large source of TCDD. This contrasts with the conclusions presented by Dow Chemical, which analyzed fly ash samples from a coal- and oil-fired chemical plant powerhouse.[62] The results of the Dow study are presented below in Section 3.2.3.2. Kimble and Gross suggest the difference in TCDD emissions between their study and the Dow study may be the nature of the fuel sources, including total chlorine content.

Ahlberg _et_ _al_.[5] analyzed flue gas samples from a 265 MW pulverized coal-fired boiler equipped with an electrostatic precipitator. The boiler was firing Polish coal with a low sulfur, high ash content. No 2378-TCDD was detected at detection limits ranging from <5.4 to <6.8 ng/m^3. The 2378-TCDF isomer was not detected at detection limits ranging from <0.86 to <1.1 ng/m^3.

3.2.3.2 _Oil and Coal Combustion_. Particulates from the stack of a coal- and oil-fired powerhouse at a Dow Chemical plant were tested for PCDD emissions.[62] TCDD, hexa-CDD, hepta-CDD, and OCDD emissions ranged from 2 to 38 ng/g with TCDD's and OCDD detected at levels of 38 ng/g and 24 ng/g, respectively. The concentration of total PCDD's was 68 ng/g. The 2378-TCDD isomer was not detected. Detection limits in this study were 20 ng/g for TCDD and 10 ng/g for 2378-TCDD. Detection limits were not specified for the other homologues which were analyzed by electron capture gas chromatography. The study did not report fuel analysis or operating conditions of the boiler.

3.2.3.3 _Oil Combustion_. Ahlberg _et_ _al_.[5] analyzed flue gas samples from a 250 MW boiler fired with a low ash, 2 percent sulfur, heavy fuel oil. The sample was taken after the heat exchanger and before the electrostatic precipitator. The 2378-TCDD isomer was not detected at detection limits ranging from <4.2 to <7.9 ng/m^3. The 2378-TCDF isomer was not detected at detection limits ranging from <0.67 to <1.3 ng/m^3.

3.2.3.4 Natural Gas Combustion. Dow Chemical tested particulate matter which had been removed from a home electrostatic precipitator in a residential, natural gas-fired forced-air heating system. The collected material represented the accumulation of material from six spring and summer months of operation of the precipitator. The particulate matter sample contained 34 ng/g hexa-CDD, 430 ng/g hepta-CDD, and 1,300 ng/g OCDD, for a total of 1,764 ng/g. The 2378-TCDD isomer was present at a level of 0.6 ng/g with a detection limit of 0.2 ng/g for the analysis. Other TCDD isomers were detected at a level of 0.4 ng/g which was also the detection limit for this sample. No detection limits were specified for the other homologues which were analyzed for by electron capture gas chromatography.

3.2.3.5 Coal and Refuse-Derived Fuel Combustion. Analysis of flue gas emissions from a coal and refuse-derived fuel (RDF)-fired facility located in Ames, Iowa, found less than detectable levels of TCDD, which was the only CDD homologue analyzed for.[115] The detection limit for TCDD was 5 ng/m^3 for vapor samples. This is a suspension fired boiler that burns coal with 15 percent RDF. Small, uniform, 2-5 cm pieces of RDF are produced in a shredding and air classification process. The facility operates with a combustion temperature of approximately 1,200°C and produces 35 MW of electrical power from steam. The unit is reported to be operated at approximately 22 percent excess air and utilizes an ESP. Another study describing emissions testing at this facility reported that PCDD's and PCDF's were not detected in the flue gas.[196] The detection limit for PCDD and PCDF was 0.25 ng/m^3 for vapor samples.

3.2.4 Wood Combustion

Table 3-6 presents the emissions data for combustion units burning PCP-treated wood and firewood.

3.2.4.1 Residential Wood Combustion. Four studies have been conducted on PCDD formation from the combustion of firewood.[54,62,165,167] Ash samples were collected from 24 woodstoves and two fireplaces. The woodstoves tested were located in rural areas in three different regions of the county.

TABLE 3-6. SOURCE CATEGORY: WOOD COMBUSTION

Source Category	No. of Units Tested (Location)	Sample	PCDD/PCDF Emission Concentration and Ash Sample Content						References
			2378-TCDD		PCDD		PCDF		
			Mean	Range	Mean	Range	Mean	Range	
Residential Woodburning									
· Woodstoves	24	Ash	0.05 ng/g (15)[b]	ND[a] - 0.20 ng/g (17)	23.4 ng/g[c] (24)	0.007 - 210 ng/g	-	-	54, 165, 167
· Fireplaces	2	Ash	1.0 ng/g (1)	-	23.3 ng/g[c] (2)	1.79 - 44.7 ng/g	-	-	62
· Oil and Wood Heater	1	Ash	0.8 ng/g	-	21.7 ng/g[c]	-	-	-	62
PCP-Treated Wood Combustion									
· Controlled Air Incinerator	1	Ash FG	- -	- -	ND[d] ND[d]	- -	ND[d] ND[d]	- -	220 220
· Incinerator	1	FG (Duct)	-	-	1520 ng/m^3	-	587 ng/m^3	-	233
· Fluidized Bed System	1	FA	-	-	324 ng/g	-	241 ng/g	-	179
· Pilot Scale Incineration	1	Stack	-	-	230,870 ng/g feed (2)	111,540 - 350,200 ng/g feed	-	-	6
· Pilot Scale Incineration									
· treated wood wool	1	Smoke gases	-	-	392,000 ng/g feed (1)	-	-	-	190
· treated birch leaves	2	Smoke gases	-	-	209,150 ng/g feed (2)	205,000 - 213,300 ng/g feed	-	-	190

" - " means no data.

[a] Not Detected. Assumed to be zero for calculations.

[b] Number in parenthesis is number of samples.

[c] Penta-CDD homologue not analyzed for.

[d] TCDD/TCDF scan only.

Presumably the wood being combusted was untreated, that is, it had not been exposed to fungicides, herbicides, or wood preservatives. For the 24 woodstoves tested, PCDD concentrations in ash samples ranged from 0.007 ng/g to 210 ng/g, with a mean concentration of 23.4 ng/g. The penta-CDD homologue was not analyzed for.[54,165] The 2378-TCDD isomer was analyzed for in 17 samples. Two samples had non-detectable levels of 2378-TCDD with detection limits ranging from 0.0009 to 0.0014 ng/g. The other 15 samples had concentrations of 2378-TCDD varying from 0.001 to 0.20 ng/g with an average concentration of 0.05 ng/g. The authors of one of the studies[165] in which 18 woodstoves were tested attributed some of the variability in the results to differences in woodstove design and sampling points. They also suggested that some of the variability could potentially be attributed to fuel contamination although feed samples were not analyzed for PCDD content.

Ash samples from the chimneys of two fireplaces were analyzed for PCDD's.[62] One fireplace was 12 years old and one was 25 years old. The 25-year-old fireplace had total PCDD concentrations of 44.7 ng/g including 1 ng/g of 2378-TCDD. Ash samples from the 12-year-old fireplace contained 1.79 ng/g PCDD. No TCDD isomers were detected at a detection limit of 0.04 ng/g. The penta-CDD homologue was not analyzed for in either of these samples.

Ash samples scraped from the flue pipe of a residential heater combusting both oil and wood were analyzed for PCDD's. After burning only oil, the PCDD level in the ash was 0.280 ng/g. By comparison, after burning only wood, the PCDD level was 0.97 ng/g. After co-firing wood and oil, 21.7 ng/g PCDD were detected, including 0.8 ng/g of the 2378-TCDD isomer. The penta-CDD homologue was not analyzed for in any of these samples.

3.2.4.2 Treated Wood Combustion. Chlorophenols are produced for use as wood preservatives, slimacides, bactericides, and as starting material for the chlorinated phenoxy acids 2,4-D and 2,4,5-T. Chlorophenols may either be contaminated with PCDD's and PCDF's, or PCDD's can be formed by the dimerization of chlorophenates during pyrolysis. The following section discusses the results of several studies where chlorophenols were combusted with wood or wood products.

Two studies concerned the combustion of pentachlorophenol (PCP) -treated military ammunition boxes.[220,233] At the Los Alamos National Laboratory in Los Alamos, New Mexico, PCP-treated wood was incinerated under a variety of test conditions in a controlled air incinerator.[220] The incinerator had modulated burners, steam injection capability, and enhanced mixing of secondary air with the primary chamber effluent. Ash samples were taken from the hot zone between the primary and secondary combustion chambers. Neither TCDD's nor TCDF's were detected at a detection limit of 17 ng/g.

At the Tooele Army Depot in Tooele, Utah, PCP-treated ammunition boxes and explosive-contaminated wastes were incinerated.[233] The incinerator was designed to decontaminate metal parts containing explosive residue. The incinerator has an unfired afterburner (refractory lined duct) with a combustion residence time of 0.3 seconds. Four tests were performed while the incinerator was firing: 1) no waste fuels, 2) wood freshly coated with PCP, 3) 40 percent by weight PCP-treated wood and 60 percent by weight contaminated waste (including wood, cloth, metal, and rubber). Results of the analysis of stack emissions for two baseline tests showed average PCDD emissions of 5.0 ng/m^3 and average PCDF emissions of 9.82 ng/m^3. The analysis of stack emissions for three tests while the 40/60 mix was fired showed average PCDD emissions of 125 ng/m^3 and average PCDF emissions of 14.2 ng/m^3. Analysis of stack emissions for three tests while freshly coated wood was fired showed average PCDD emissions of 8,215 ng/m^3 and average PCDF emissions of 426 ng/m^3. When only ammunition boxes were incinerated, duct samples were taken. Analysis of duct samples showed PCDD emissions of 1,420 ng/m^3 and PCDF emissions of 587 ng/m^3.

A pilot scale incinerator was used to burn wood chips which had been mixed with technical grade tri- and tetrachlorophenate.[6] At combustion temperatures of 500 to 800°C (932 to 1,472°F), the formation of PCDD's was demonstrated. At higher temperatures, the formation of PCDD's decreased. When wood chips and trichlorophenate were burned, stack emissions of total PCDD's were 111,540 ng/g feed. When tetrachlorophenate was burned with wood chips, stack emissions contained 350,200 ng/g feed. Addition of copper salts to the tetrachlorophenate formulation and increasing the residence time within the incinerator reduced the emission of PCDD's.

In another study, fly ash samples from a fluidized bed system burning PCP-treated wood, painted wood, and hypochlorite-treated paper were analyzed.[179] Total PCDD's and PCDF's detected in fly ash samples after burning painted wood were 177 ng/g and 217 ng/g, respectively. When PCP-treated wood was burned, PCDD levels in the fly ash were 324 ng/g and PCDF levels were 241 ng/g. When the hypochlorite-treated paper was burned, large amounts of chlorine were present but PCDD and PCDF levels were relatively low with 24 ng/g of PCDD detected and 12 ng/g PCDF detected. The addition of pentachlorophenol to these fuels did not increase PCDD or PCDF emissions.

In a pilot scale study, two chlorophenate formulations, Servarex and Kymmene KY-5 were sprayed over wood wool and birch leaves and combusted in an open fire.[190] These formulations are mixtures of 2,4,6 tri-, 2,3,4,6 tetra- and pentachlorophenate as sodium salts. PCDD's and PCDF's were detected in these two formulations at concentrations of 20 and 150 ppm, respectively. When Servarex and KY-5 were each burned separately, high levels of PCDD's were formed. When burned alone, the Servarex formed 21,600 ng/g of PCDD and the KY-5 formed 11,600 ng/g of PCDD. Each of these was then sprayed over birch leaves and wood wool and combusted in an open fire. One gram of chlorophenate was dissolved in 20 ml of water and sprayed over 30 grams of birch leaves or wood wool. Smoke gases were trapped in charcoal filters and analyzed. When birch leaves sprayed with Servarex were burned, 213,300 ng/g feed of PCDD's were formed. When wood wool and Servarex were burned, 392,000 ng/g feed of PCDD's were formed. When birch leaves and KY-5 were burned, 205,000 ng/g feed of PCDD's were formed. Purified chlorophenates were also burned with birch leaves. When 2,4,6 trichlorophenate and pentachlorophenate were burned with birch leaves, levels of PCDD's formed were 1,115,000 ng/g feed and 957,200 ng/g feed, respectively.

3.2.5 Boilers Co-Firing Wastes

Table 3-7 represents the emissions data for boilers co-firing wastes. EPA's Air & Energy Engineering Research Laboratory (AEERL) (formerly

TABLE 3-7. SOURCE CATEGORY: BOILERS COFIRING WASTES

Type of Facility	No. of Units Tested (Location)	Sample	PCDD/PCDF Emission Concentration and Ash Sample Content: 2378-TCDD Mean	2378-TCDD Range	PCDD Mean	PCDD Range	PCDF Mean	PCDF Range	References
Industrial Boilers	1	FG	ND[a]	-	75 ng/m^3[b]	-	-	-	40
	4	FG	.002 ng/m^3[c] (1)	-	0.51 ng/m^3 (4)	ND - 1.1 ng/m^3	1.9 ng/m^3 (4)	0.15 - 5.5 ng/m^3	40
Industrial Boilers	3	FG	-	-	ND	-	-	-	41
	1	FG	<0.28 ng/m^3	<0.4 - <1.5 ng/m^3	75.5 ng/m^3 (2)	74.6 - 76.4 ng/m^3	-	-	41
Commercial Boilers (Spiked Waste oil)	3	FG	-	-	7630 ng/m^3[d] (3)	1400 - 17000 ng/m^3[d]	-	-	81
	3	FG	-	-	ND	-	170 ng/m^3[e]	-	81
	1	FA	-	-	911 ng/g		3777 ng/g	-	81
Industrial Boiler	1 (Switzerland)	FA	-	-	600 ng/g	-	300 ng/g	-	33
Utility Boiler	1	FG	-	-	ND	-	ND	-	96

"-" means no data

[a] Not detected

[b] PCDD's detected in feed samples

[c] 2378 TCDD detected in only 1 boiler at detection limit

[d] average and range of TCDD and OCDD from 3 different boilers

[e] TCDF detected in emission from one boiler

[f] penta through octa homologues only

Industrial Environmental Research Laboratory (IERL)) conducted studies on industrial boilers co-firing waste products.[41] Four boilers co-firing chlorinated wastes such as creosote sludge, chlorinated solvents, and waste oil were tested. Stack emissions from three of the four boilers were tested for PCDD's at a detection limit of 1,000 ng/m^3 but none were detected. The fourth boiler was a steam generator firing waste wood contaminated with pentachlorophenol. Stack emissions of 2378-TCDD from this boiler ranged from <0.4 to <1.5 ng/m^3. Total PCDD stack emissions ranged from 74.6 to 76.4 ng/m^3 and averaged 75.5 ng/m^3.

A second study for EPA's Hazardous Waste Engineering Laboratory tested waste fuels and stack gas emission samples from five industrial boiler test sites co-firing hazardous waste fuels.[40] Among the wastes being fired were creosote sludge, carbon tetrachloride, chlorobenzene, methanol, toluene, and trichloroethylene. A watertube boiler co-firing wastes and No. 6 oil was the only boiler having detectable levels of 2378-TCDD in flue gas emissions. However, the measured value for the emission of this isomer was equal to the 0.002 ng/m^3 detection limit. This boiler also had the highest total CDF emissions of 5.5 ng/m^3 in one of two samples. A creosote/wood-fired stoker had the highest total PCDD stack emissions (75 ng/m^3) but the creosote sludge co-fired with wood waste in this boiler was found to contain 7,400 ng/g of total PCDD. PCDD and PCDF homologues were not detected in any other chlorinated waste at detection limits ranging from 0.045 to 4.6 ng/g. Stack concentrations of PCDD from the other four boilers ranged from less than detectable to 1.1 ng/m^3 at detection limits ranging from 0.0022 ng/m^3 to 0.019 ng/m^3.

In another study, Buser, Bosshardt, and Rappe[33] report the identification of 600 ng/g and 300 ng/g of PCDD's and PCDF's, respectively, in the fly ash of an "industrial heating facility." This facility was generating steam by co-firing used industrial oils. PCDD's and PCDF's were detected in other fly ash samples as well but the samples with the highest concentrations were the only ones reported.

The EPA tested six commercial boilers firing spiked waste oil.[81] The boilers were in the size range of 0.4 to 25 million Btu/hr heat input capacity. The fuel was used automobile oil spiked with organic compounds such as chloroform, trichlorobenzene, chlorotoluene, and trichloroethylene at levels ranging from 1,500 ppm to 10,000 ppm.

Of the six boilers, only one had detectable levels of OCDD with 4,500 ng/m^3 and 17,000 ng/m^3 detected in one of three samples of stack gas. Detection limits were not specified for these samples. Only one of the six boilers had detectable levels of TCDF with 170 ng/m^3 detected in stack gas. Detection limits were not specified for the other samples with less than detectable levels. The feed samples of waste oil basestock and the "spiked" waste oil were tested and no PCDD's or PCDF's were detected at detection limits ranging from 0.04 ng/g to 2.0 ng/g. Fly ash samples collected from a Scotch firetube boiler did not have detectable levels of TCDD, but the concentration of penta through octa homologues ranged from not detectable to 230 ng/g. For three fly ash samples total PCDD's were 911 ng/g. Detection limits ranged from 0.5 to 10 ng/g. Concentrations of PCDF homologues ranged from not detectable to 1,000 ng/g for a total of 3,777 ng/g in three samples. Detection limits ranged from 0.5 to 10 ng/g.

A 233 MW utility boiler was tested while firing No. 6 oil and PCB-spiked waste oil.[96] The waste oil comprised 10 percent of the total fuel. PCDD's and PCDF's were not detected in stack gas emissions at detection limits ranging from 0.031 to 0.10 ug/m^3.

3.2.6 Hazardous Waste Incinerators

Table 3-8 presents the emissions data for land-based incinerators and incinerator ships.

3.2.6.1 Land-Based Incinerators. Eleven incinerators firing hazardous wastes were the focus of ten studies. Among the types of units tested were rotary kilns, with and without afterburners, a mobile rotary kiln incinerator, and a tar burner. Wastes being fired typically consisted of chlorine-containing liquid organic wastes, herbicides, and wastes containing PCB's.

An incinerator was tested while firing feed containing 3,000 ug/g PCB's.[136] Cyclone outlet samples were analyzed by selective ion monitoring GC-MS. PCDD's and PCDF's were not detected at detection limits ranging from

TABLE 3-8. SOURCE CATEGORY: HAZARDOUS WASTE INCINERATORS

Type of Facility	No. of Units Tested (Location)	Sample	PCDD/PCDF Emission Concentration and Ash Sample Content						References
			2378-TCDD		PCDD		PCDF		
			Mean	Range	Mean	Range	Mean	Range	
Land-based facilities:									
Fluid wall reactor	1	cyclone	-	-	ND[a]	-	ND	-	136
Rotary kiln	1 (Rollins)	FG	-	-	2.75 ng[b] (3)[c]	ND - 6.94 ng	11.8 ng[b] (3)	ND - 22ng	234
Rotary kiln	1 (ENSCO)	FG	-	-	0.37 ng[b] (3)	ND - 0.48 ng	2.7 ng[b] (3)	ND - 6 ng	234
Rotary kiln	1	FG	ND	-	75 ng/train[d] (1)	-	190 ng/train[e] (1)	-	246
Rotary kiln	1	FG	-	-	8.6 ng/m^3 (4)	ND - 45.5 ng/m^3	11.2 ng/m^3 (4)	ND - 20.3 ng/m^3	88
Rotary kiln	1 (Dow)	FG	-	-	7.7 ng/m^3	-	19 ng/m^3	-	153[a]
Incinerator w/Afterburner	1	Ash	-	-	538 ng/g (1)	-	2853 ng/g (1)	-	74
Mobile Incinerator	1	Ash	-	-	91.3 ng[f]	-	-	-	108
Rotary kiln without supplemental fuel	1 (Dow)	Part.	1870ng/g[g]	ND - 5500 ng/g	323,570[g] (3)	9,710 - 847,400 ng/g	-	-	62

TABLE 3-8. SOURCE CATEGORY: HAZARDOUS WASTE INCINERATORS
(cont'd.)

Type of Facility	No. of Units Tested (Location)	Sample	PCDD/PCDF Emission Concentration and Ash Sample Content						References
			2378-TCDD		PCDD		PCDF		
			Mean	Range	Mean	Range	Mean	Range	
Tar Burner	1 (Dow)	Part.	ND (4)	-	406 ng/g[h] (4)	256 - 572 ng/g	-	-	62
Rotary Kiln with supplemental fuel	1 (Dow)	Part.	ND (5)	-	267 ng/g[h] (4)	13 - 1064 ng/g	-	-	
Rotary Kiln	2	FG	-	-	ND	-	ND	-	161
Rotary Kiln	1	FG	-	-	ND	-	0.7 ng/m^3[i]	-	161
Incinerator Ship		FG	-	-	ND[b]	-	-	-	1
		FG	ND	-	ND[b]	-	-	0.3 - 3 ng/m^3[b]	

" - " means no data.

[a] Not detected. Assumed to be zero in calculations.

[b] TCDD/TCDF scan only.

[c] Number in parenthesis is number of samples used in calculations.

[d] Penta-CDD, hepta-CDD, OCDD homologues only.

[e] Penta-CDF homologue only.

[f] Loss of sample prevented concentration calculation.

[g] One of 3 tests had high results due to non-specific analytical method.

[h] Hexa-CDD, Hepta-CDD, OCDD homologues only.

[i] Penta-CDF homologue only.

0.03 to 0.06 ug/m^3. Because PCDD's and PCDF's were not detected in the cyclone samples, analyses of stack samples were not performed.

One study tested two rotary kilns with afterburners.[234] Three tests each were performed at incinerator facilities at El Dorado, Arkansas, and Deer Park, Texas. Test results were reported in terms of total quantities present in the analyzed sample because leakage and loss of unknown quantities of most samples occurred during shipment preventing the calculation of actual concentrations. The facilities are operated by Energy Systems Company (ENSCO) and Rollins Environmental Services, respectively. Wastes during the first test at each facility included hydrocarbon wastes, paint and ink manufacturing wastes, pesticide process wastes, and vinyl chloride still bottoms. The Rollins facility had total TCDD and TCDF levels of 6.94 ng and 13.5 ng, respectively. The second test consisted of the same wastes as the first test with the addition of liquid PCB wastes. The Rollins facility during the second test had total TCDD and TCDF levels of 1.42 ng and 22 ng, respectively. The ENSCO facility during the second test had total TCDD and TCDF levels of 0.48 ng and 6 ng, respectively. For the third test, liquid PCB wastes were fired with clean fuel oils. The Rollins facility had less than detectable TCDD's at detection limits ranging from 0.48 to 0.9 ng and 2 ng for TCDF. The ENSCO facility had less than detectable levels of TCDD and TCDF at detection limits of 0.2 to 0.45 ng for TCDD's and from 0.08 to 0.5 ng for TCDF's.

A rotary kiln operating at 1,200°C was tested while burning Silvex herbicide.[246] The 2378-TCDD isomer was not detected at a detection limit of 1 ppb (by volume). The penta-CDD, hepta-CDD, and OCDD homologues were detected at a total of 75 ng/MM5 train. The penta-CDF homologue was present at a concentration of 190 ng/MM5 train.

In an unrelated study, stack emissions from a rotary kiln operating at 1,200°C were analyzed.[88] Four tests were conducted while PCB's were being incinerated. The average concentration of PCDD's and PCDF's was 8.6 and 11.2 ng/m^3, respectively. However, TCDD's and OCDD's were the primary homologues detected. Detection limits for the other homologues were not reported.

The incinerator exhaust of the rotary kiln waste incinerator at Dow Chemical was tested.[153a] This incinerator destroys 20 tons/day of liquid waste in the 1,025°C afterburner and 185 tons/day of solid and liquid combustible trash including 1.5 tons/day of chlorophenolic wastes from the 2,4-dichlorophenol and 2,4-D processes. The average concentrations of PCDD's and PCDF's detected were 7.7 ng/m^3 and 29 ng/m^3, respectively.

At another facility, used transformer oil (supposedly containing less than 50 ppm PCB's) is fired in an incinerator.[74] A spot check on the used oil detected one sample with 90 ppm PCB's. The incinerator, which has secondary combustion chambers and an afterburner, burns off the insulation from the aluminum or copper windings from dismantled transformers. One composite ash sample was analyzed and found to contain 538 ng/g PCDD's and 2,853 ng/g PCDF's.

A mobile incinerator was tested while firing CDD-contaminated liquid still bottoms and soil during one test and CDD-contaminated lagoon sediment (containing 1-21 ppb 2378-TCDD) during a second test.[108] The only homologue detected was OCDD at a total of 91.3 ng/g in three samples. These detectable levels were suspected to be from contaminated solvent used in the analyses. It was unlikely the OCDD was formed during the incineration process.

Dow Chemical tested an industrial solid waste incinerator (rotary kiln) and a tar burner.[62] The tar burner was a 72 million Btu/hr unit with natural gas burned as a supplemental fuel. Four tests were conducted while the unit was firing natural gas and tars. The 2378-TCDD isomer and other TCDD's were not detected in particulate matter samples. Detection limits ranged from 1.3 to 3.0 ng/g for the 2378-TCDD isomer and from 0.7 to 1.2 ng/g for other TCDD's. Total concentrations of the hexa-CDD, hepta-CDD, and OCDD homologues ranged from 256 to 572 ng/g for the four tests with an average of 406 ng/g. The penta-CDD homologue was not analyzed for.

The rotary kiln incinerator Dow Chemical tested was a 70 million Btu/hr unit. This unit is capable of incinerating both solids and liquids. Supplemental fuel is also burned in this unit in the rotary kiln and the secondary combustion chamber to maintain combustion temperatures. Three tests were performed while the kiln was burning tars, solid waste, and

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Five tests were then conducted on this rotary kiln while oil and natural gas, and tars and natural gas were fired as supplemental fuel in the secondary combustion chamber. The 2378-TCDD isomer and other TCDD's were not detected in particulate matter from any of the five tests. Detection limits ranged from 2 to 5 ng/g for the 2378-TCDD isomer and from 2 to 8 ng/g for the other TCDD isomers. Total concentrations of the hexa-CDD, hepta-CDD, and OCDD homologues ranged from 13 to 1,064 ng/g with an average for the five tests of 267 ng/g. The penta-CDD homologue was not analyzed for.

Results from three tested rotary kilns were reported in one study.[161] Only one of the kilns had detectable TCDF emissions at a concentration of 0.7 ng/m^3. However, TCDF's were detected in the fuel which was liquid organic waste containing 0.4 to 1 percent chlorine. The other two kilns were firing liquid organic solvents with chloride concentrations ranging from 0.2 to 16 percent chlorine. No TCDD's or TCDF's were detected in the flue gas or feed. Detection limits were unavailable.

3.2.6.2 Incinerator Ships. Two studies were conducted with the Vulcanus incinerator ship.[1,2] The first study was conducted during the incineration of Herbicide Orange contaminated with 2378-TCDD.[1] TCDD levels in the feed ranged from less than detectable to 2,800 ng/ml, with an average concentration of 1,820 ng/ml injected. The detection limit for the feed samples was 20 ng/ml injected. No TCDD's were detected in the stack emissions. Detection limits for the TCDD's were very variable due to the complexity of the samples. Detection limits ranged from 0.0009 ng/ml injected to 0.086 ng/ml injected into the GC-MS for analysis.

The second study was conducted during a PCB burn.[2] TCDD's, including the 2378-TCDD isomer, were not detected in the feed or in stack emissions. Detection limits ranged from 2 to 22 ng/g. TCDF's were detected in all samples of waste and in several samples of stack gas. The analytical method could not distinguish the 2378-TCDF isomer from the other 37 TCDF isomers. Total concentrations of TCDF's in stack gas samples were reported to range from <0.3 to <3 ng/m^3.

3.2.7 Lime/Cement Kilns

Table 3-9 presents emissions data for lime/cement kilns.

Four studies have addressed PCDD and PCDF emissions from lime or cement kilns co-firing wastes.[20a,20b,58a,184] The combustion temperature of this process is about 1500°C with a typical residence time of 1.5 seconds.

A cement kiln at San Juan Cement was tested while co-firing liquid organic wastes containing from 6.5 to 35.5 percent chlorine (by weight).[184] Flue gas and particulate samples were taken. One of the four SASS train samples had detectable levels of hexa-CDF and hepta-CDF. The concentrations of these two homologues were 1.35 ng/m^3 and 0.74 ng/m^3, respectively. None of the other homologues were detected at detection limits ranging from 1.6 to 4.9 ng/m^3. Similarly, one of the EPA Method 5 filters used for particulate analysis contained 11.0 ug/m^3 of penta-CDF, 25.7 ng/m^3 hexa-CDF, and 8.1 ng/m^3 hepta-CDF. None of the other particulate samples had detectable PCDF's at detection limits ranging from 5 to 15 ng/filter. These detectable emissions occurred when the kiln was fed waste containing 21.4 percent chlorine which corresponds to a chlorine input of 3.5 percent of total fuel input. This resulted in a potentially kiln-damaging condition. The study maintains the detectable emission occurred only during "upset" conditions. Under other conditions PCDF's were not emitted, and PCDD's were not emitted under any condition including the "upset" conditions. Detection limits

TABLE 3-9. SOURCE CATEGORY: LIME/CEMENT KILNS

Type of Facility	No. of Units Tested (Location)	Sample	PCDD/PCDF Emission Concentration and Ash Sample Content						References
			2378-TCDD		PCDD		PCDF		
			Mean	Range	Mean	Range	Mean	Range	
Cement kiln (San Juan Cement)	1	FG	-	-	ND[a]	-	2.09 ng/m^3 (1)	-	184
		Part.	-	-	-	-	44.8 ng/m^3	-	184
Cement kiln (General Portland)	1	FG	-	-	ND	-	ND	-	20[a]
Cement kiln (Lone Star Cement)	1	FG	-	-	ND	-	ND	-	20[b]
Lime Kiln (Rockwell Lime)	1	Part.	-	-	ND	-	ND	-	58[a]
		Baghouse Dust	-	-	ND	-	ND	-	58[a]

" - " means no data.

[a]ND - Not detected

ranged from 1.6 to 4.9 ng/m^3 for stack gas emissions, and from 5 to 15 ng/filter for the particulate analysis.

A wet-process cement kiln at General Portland Cement, Inc., and a dry-process cement kiln at Lone Star Cement were tested.[20a,20b] Both of these facilities were co-firing hydrocarbon solvents, chlorine-containing wastes, and wastes spiked with Freon 113. No PCDD's or PCDF's were detected in stack emissions at the detection limit of 1 ng/ul injected (into the GC-MS for analysis).

A lime kiln at Rockwell Lime Company was tested while firing petroleum coke and waste fuel consisting of lacquer thinner solvents, alcohols, and paint wastes.[58a] The wastes contained approximately 3 percent chlorine (by volume). PCDD's were not detected in baghouse dust or EPA Method 5 filters. For baghouse dust samples, detection limits ranged from 0.005 to 0.25 ng/g. For EPA Method 5 filters, detection limits were converted to stack gas concentration and ranged from 0.034 to 2.0 ng/m^3.

3.2.8 Hospital Incinerators

Table 3-10 presents emissions data from hospital incinerators.

High temperature incineration is the preferred method for disposal of hospital wastes containing infectious or hazardous materials. Most hospital incinerators of older design are incapable of destroying all hazardous materials and have inefficient combustion leading to emission of hazardous air pollutants. Hospital wastes are also highly variable in content. They usually contain 20 percent plastics, compared to municipal solid waste which contains 3 to 7 percent plastics. Combustion of plastics composed of polyvinyl chloride and other halogenated polymers and copolymers can be a major generator of toxic air emissions.

A 1983 stack test on a Canadian hospital incinerator found PCDD's and PCDF's to be emitted at average levels of 69 ng/m^3 and 156 ng/m^3, respectively.[31a] The test was performed on a high combustion efficiency controlled-air, two-chamber incinerator. Small amounts of PCDD's and PCDF's were detected in the bottom ash, with much higher levels in the fly ash.

Doyle *et al*.[62a] reported results from three hospital incinerators in the United States. Stack test filter samples were analyzed and had average

TABLE 3-10. SOURCE CATEGORY: HOSPITAL INCINERATORS

Type of Facility	No. of Units Tested (Location)	Sample	PCDD/PCDF Emission Concentration and Ash Sample Content						References
			2378-TCDD		PCDD		PCDF		
			Mean	Range	Mean	Range	Mean	Range	
Canadian	1	FG	-	-	69 ng/m^3 (1)	52 - 84 ng/m^3	156 ng/m^3 (1)	117 - 197 ng/m^3	31[a]
U. S.	3	FG			15 ng/m^3 (3)	-	25 ng/m^3 (3)	-	62[a]

" - " means no data

levels of PCDD's and PCDF's of 15 ng/m^3 and 25 ng/m^3, respectively. According to Doyle et al., these levels probably represent less than one-half the actual emissions because more than 50 percent of PCDD's and PCDF's can be found in the vapor phase which was not analyzed in these particulate screening tests.

3.2.9 Wire Reclamation Incinerators

Table 3-11 presents emissions data from one study conducted on a wire reclamation incinerator.[103] Wire insulation incinerated during this process often contains PCB's and polyvinyl chloride. Analyses of inorganics in the stack and furnace samples from the three furnaces revealed high levels of copper and lead as well as 85,500 ppm of chloride in one of the furnace samples.

Total TCDD and total TCDF concentrations in stack fly ash scrapings were 0.41 ng/g and 11.6 ng/g, respectively. Bottom ash samples from the furnace contained 0.058 ng/g total TCDD's and 0.730 ng/g total TCDF's. The analyses did not distinguish the 2378-TCDD or 2378-TCDF isomers; only total TCDD's and TCDF's were measured.

3.2.10 PCB Fires

Table 3-12 presents emissions data concerning several studies. In September 1978, 18 capacitors containing PCB's were burned in a fire at a transformer station near Stockholm, Sweden.[110] Several types of samples were taken. Liquid from inside an exploded capacitor contained 75,000 ng/g PCDF.

In Binghamton, New York, in 1981, an electrical transformer containing about 1,100 gallons of PCB's was involved in an incident described as an explosion.[60] Total PCDF homologues in soot were initially found to be as high as 2,160,000 ng/g. The 2378-TCDF isomer accounted for 12,000 ng/g of total PCDF's. The hexa-CDF homologue alone accounted for 965,000 ng/g of total PCDF's. Total PCDD's were found at a concentration of 20,000 ng/g including 600 ng/g 2378-TCDD.

In January 1982, an electrical fire involving PCB's broke out in a Boston, Massachusetts, office building.[60] One bulk soot sample contained a total of 115,000 ng/g PCDF's including 60,000 ng/g TCDF. No PCDD's were detected at a detection limit of 100 ng/g.

TABLE 3-11. SOURCE CATEGORY: WIRE RECLAMATION INCINERATORS

Type of Facility	No. of Units Tested (Location)	Sample	PCDD/PCDF Emission Concentration and Ash Sample Content						References
			2378-TCDD		PCDD		PCDF		
			Mean	Range	Mean	Range	Mean	Range	
Wire Reclamation Incinerator	1 Midwestern USA	FA (Stack)	-	-	0.41 ng/g[a]	-	11.6 ng/g[a]	-	103
		ASH (Furnace)	-	-	0.58 ng/g[a]	-	0.73 ng/g[a]	-	103

" - " means no data

[a] TCDD and TCDF scans only.

TABLE 3-12. SOURCE CATEGORY: PCB FIRES

Type of Facility	No. of Units Tested (Location)	Sample	PCDD/PCDF Emission Concentration and Ash Sample Content						References
			2378-TCDD		PCDD		PCDF		
			Mean	Range	Mean	Range	Mean	Range	
Capacitor Battery	1 Stockholm	Liquid	-	-	-	-	75,000 ng/g	-	110
Transformer Vault	1 Binghamton, New York	Soot	600 ng/g	-	19,400 ng/g	-	2,160,000 ng/g	-	60
Transformer Vault	1 Boston, MA	Soot	-	-	ND	-	115,000 ng/g	-	60
Capacitor Battery	1 Skovde, Sweden	Wipes	-	-	-	-	772 ng/m^2	-	192
Transformer Vault	1 Miami, FL	Soot	-	-	ND[b]	-	1710 ng/g	-	99
Capacitor Battery	1 Surahammar, Sweden	Wipes	-	-	-	-	7480 ng/m^2 (2)[a]	4060 - 10,900 ng/m^2	76
Transformer Vault	1 San Francisco California	Soot	59 ng/g	-	324 ng/g[c]	-	28,900 ng/g[c]	-	158
Transformer Cores	1 Washington State	Ash	-	-	5.2 ng/g[d]	-	41.4 ng/g	-	218

" - " means no data

[a] Number of samples

[b] Not detected

[c] TCDD/TCDF scan only

[d] Hepta-CDD and OCDD homologues only

In March 1982, a fire broke out in a capacitor battery in a metal treatment factory in Skovde, Sweden.[192] The capacitors contained mineral oil and PCB's. Wipe tests were taken from several locations and results were reported in terms of unit area. Samples taken 0.5 meters from the capacitor on the floor had the highest levels of PCDF's with 100 ng/m^2 2378-TCDF and 772 ng/m^2 PCDF's.

In Miami, Florida, during April 1982, a fire and explosion occurred when an underground transformer vault exploded releasing approximately 100 gallons of PCB transformer oil onto the floor.[99] Smoke ejector fans were set up to ventilate the vault. Samples of soot and other residue from the fire were collected. Wipe samples were also taken from surfaces near the fire scene. Four bulk samples of soot and other residue, and three hexane wipe samples were analyzed. No PCDD's were detected in these samples at a detection limit of 10 ng/g. PCDF's from tri-CDF to hexa-CDF were detected in two of the six samples. The soot and dust sample taken from a cable support bracket contained 1,710 ng/g tetra- through octa-PCDF homologues. Soot taken from the ejector fan contained 670 ng/g tetra- through octa-PCDF homologues. The 2378-TCDF isomer was not detected at detection limits of 10 ng/g and 100 ng/g.

In September 1982, molten steel at a steel mill in Surahammar, Sweden, ignited a 500-unit capacitor battery.[76] The capacitors were filled with two tons of PCB's and three tons of mineral oil. Wipe samples from several locations were analyzed. Results were reported in terms of unit area. Two samples from the capacitor room had an average of 620 ng/m^2 2378-TCDF and an average 7,480 ng/m^2 of tetra- through octa-PCDF homologues.

In 1983, in San Francisco, California, a fire started in a transformer vault containing three transformers filled with PCB's.[158] It was reported that only one transformer leaked. The liquid remaining contained 127 ng/g total TCDD's and 59 ng/g 2378-TCDD.

A fire in Washington State in 1984, involved transformer oil and cores.[218] A grab sample of the ash was analyzed and found to contain 41.4 ng/g PCDF's and 2.7 ng/g and 2.5 ng/g of the hepta-CDD and OCDD homologues, respectively.

3.2.11 Automobile Emissions

Table 3-13 presents data from automobiles.

Dow Chemical and the U. S. EPA each conducted a study on emissions from automobiles.[62,213] Dow Chemical collected particulate solids from seven types of mufflers. Results were reported for three cars burning gasoline and two trucks using diesel fuel. Samples were analyzed by GC-MS and GC-EC. Results from the GC-MS analyses are reported here except where noted. Samples from one car with leaded gasoline and no catalytic converter had no detectable 2378-TCDD and 0.004 ng/g other TCDD's. The detection limit for the 2378-TCDD isomer was 0.002 ng/g. Hexa-CDD and hepta-CDD were not detected at detection limits of 0.014 ng/g and 0.006 ng/g, respectively, while 0.016 ng/g of the OCDD homologue were present.

The second car had been burning unleaded gasoline and was equipped with a catalytic converter. The 2378-TCDD, other TCDD's and hexa-CDD were not detected at detection limits of 0.003 ng/g, 0.001 ng/g, and 0.01 ng/g, respectively. The hepta-CDD and OCDD homologues were detected at levels of 0.014 ng/g and 0.068 ng/g, respectively.

The third car sampled was burning unleaded gasoline with a catalytic converter and had relatively low mileage (~15,000 miles). The 2378-TCDD isomer was not detected at detection limits of 0.0002 ng/g. Concentration of the other TCDD's were 0.0001 ng/g which equaled the detection limit. The hexa-CDD homologue was detected at 0.0005 ng/g by electron capture gas chromatography (GC-EC) but these results were not confirmed by GC-MS analysis. GC-EC analysis of the particulate matter samples detected 0.002 ng/g hepta-CDD and 0.008 ng/g OCDD. These positive results were confirmed by GC-MS.

For samples from one of the diesel mufflers, GC-MS analysis did not detect 2378-TCDD, other TCDD's or hexa-CDD at detection limits of 0.003 ng/g, 0.007 ng/g, and 0.025 ng/g, respectively. Levels of hepta-CDD and OCDD were 0.110 ng/g and 0.280 ng/g, respectively. The second diesel muffler had 0.003 ng/g 2378-TCDD, 0.02 ng/g TCDD, 0.02 ng/g hexa-CDD, 0.10 ng/g hepta-CDD, and 0.26 ng/g OCDD.

TABLE 3-13. SOURCE CATEGORY: AUTOMOBILE EMISSIONS

Type of Facility	No. of Units Tested (Location)	Sample	PCDD/PCDF Emission Concentration and Ash Sample Content						References
			2378-TCDD		PCDD		PCDF		
			Mean	Range	Mean	Range	Mean	Range	
Automobiles Burning:									
Leaded Gas	1	Scraping	ND[a]	-	0.004 ng/g[c] (1)[b]	-	-	-	62
Leaded Gas	3	Filter Extract	2.98 ng/g	-	47.7 ng/g[d]	-	-	-	213
Unleaded Gas/ Catalyst	1	Scraping	ND	-	0.08 ng/g[c]	-	-	-	62
Unleaded Gas/ Catalyst	10	Filter Extract	1.4 ng/g (1)	-	37.4 ng/g[d] (1)	-	-	-	213
Unleaded Gas/ Chevette	1	Filter Extract	0.28 ng/g (1)	-	7.5 ng/g[d] (1)	-	-	-	213
Unleaded Gas/ Catalyst/ Low Mileage	1	Scraping	ND	-	0.01 ng/g[c,e]	-	-	-	62
Diesel Truck	2	Scraping	0.0015 ng/g (2)	ND - 0.003	0.395 ng/g (2)	0.39 - 0.40 ng/g	-	-	62
Diesel Car	2	Filter Extracts	ND	-	ND[d]	-	-	-	213

" - " means no data

[a] Not detected, assumed to be zero for calculations

[b] Numbers in parentheses are number of samples calculations are based on.

[c] Analysis for TCDD, Hexa-CDD, Hepta-CDD, and OCDD only

[d] TCDD scan only

[e] Analysis of Hexa-CDD homologue by GC-EC was not confirmed by GC-MS

The U. S. EPA analyzed four composites of filter extracts from several automobiles. Each of the extracts was analyzed by GC-MS with a detection limit of 0.04 ng. Results were reported in terms of ng per sample with the weight in grams of the sample also noted. For the purposes of this report the reported values were recalculated to reflect the concentration of TCDD's in ng/g.

A pooled sample from two diesel cars contained no detectable 2378-TCDD or other TCDD's. Pooled filter extracts from three cars burning leaded gasoline contained 2.98 ng/g of the 2378-TCDD isomer and 47.7 ng/g of four other unspecified TCDD isomers. Samples from 10 cars with catalysts burning unleaded gasoline comprised the third sample. The 2378-TCDD isomer was detected at a concentration of 1.4 ng/g. Nine other TCDD isomers were detected at a concentration of 37.4 ng/g. The fourth sample was composed of a filter extract from a catalytic car burning unleaded gasoline. The car was malfunctioning and had excessive oil consumption. It was tested separately because its extractable particulate emissions were so high its full inclusion in the catalyst pool would have skewed the data. It was included in the catalyst composite pool at one-tenth its normal emission rate. Particulate extracts from this vehicle contained 0.28 ng/g 2378-TCDD and 7.5 ng/g of 10 other unspecified TCDD isomers.

3.2.12 Activated Carbon Regeneration Furnaces

Table 3-14 presents two studies which were conducted on activated carbon regeneration at the Cincinnati Waterworks, Cincinnati, Ohio.[13,156] The first study tested emissions from the fluidized bed system before an afterburner was installed.[13] The carbon regenerated during the first study had been in service for approximately one year. Pre-chlorination of the wastewater (relative to the granular activated carbon bed) was in use.

Concentrations of 2378-TCDD in the flue gas ranged from 0.01 to 0.21 ng/m^3 with an average of 0.1 ng/m^3. TCDD concentrations in the flue gas ranged from 0.06 to 0.3 ng/m^3 with an average concentration of 0.17 ng/m^3. Flue gas concentrations of TCDF ranged from 0.08 to 0.51 ng/m^3 with an average of 0.3 ng/m^3. For particulate samples, concentrations of the 2378-TCDD isomer ranged from 4.3 to 51 ng/g with an average of 25 ng/g.

TABLE 3-14. SOURCE CATEGORY: ACTIVATED CARBON REGENERATION

Type of Facility	No. of Units Tested (Location)	Sample	PCDD/PCDF Emission Concentration and Ash Sample Content						References
			2378-TCDD		PCDD		PCDF		
			Mean	Range	Mean	Range	Mean	Range	
Fluidized Bed w/o Afterburner	1	FG	0.1 ng/m^3 (4)[a]	0.01 - 0.21 ng/m^3	0.18 ng/m^3 (4)	0.06 - 0.3 ng/m^3	0.3 ng/m^3 (4)	0.08 - 0.51 ng/g^3	13
		Part.	25 ng/g (4)	4.3 - 51.2 ng/g	48 ng/g (4)	36 - 66 ng/g	103 ng/g (4)	ND[b] - 245 ng/g	13
Fluidized Bed w/ Afterburner	1	FG (Stack)	ND	-	1.58 ng/m^3[c]	-	0.05[d] ng/m^3	-	156
		FG (Recup)	ND	-	1.59 ng/m^3 (4)	ND - 3.71 ng/m^3	1.37 ng/m^3 (4)	0.015 - 4.76 ng/m^3	156
		FG (Afterburner) 1 sec.	ND	-	.012 ng/m^3[e]	-	0.44 ng/m^3	-	156
		FG (Afterburner) 2 sec.	ND	-	0.7 ng/m^3 (2)	ND - 1.4 ng/m^3	0.29 ng/m^3 (2)	0.19 - 0.39	156

" - " means no data

[a] Number in parenthesis is number of samples used for calculations

[b] Not detected

[c] Hepta-CDD and OCDD homologues only

[d] Hexa-CDF, Hepta-CDF, OCDF homologues only

[e] TCDD scan only

Concentrations of TCDD ranged from 36 to 66 ng/g with an average concentration of 48 ng/g. For TCDF's, concentrations ranged from less than detectable to 245 ng/g with an average concentration of 103 ng/g in particulate samples. The detection limit for TCDF's was 4 ng/g.

The second study at this facility took place after installation of an afterburner.[156] The afterburner is located in the off-gas stream from the fluidized bed reactivation unit. The average temperature of the afterburner during the test period was 2500°F. Post-chlorination of the wastewater (relative to the granular activated carbon bed), rather than pre-chlorination, was in use during the second study. The carbon being regenerated had been in use 200 days.

Emissions from the stack, afterburner, and recuperator were tested. The 2378-TCDD isomer was not detected in any of the samples. PCDD levels in stack samples were 1.58 ng/m^3, but only the hepta-CDD and OCDD homologues were present. PCDF concentrations in stack samples were 0.5 ng/m^3. In these samples, the hexa-CDF, hepta-CDF and OCDF homologues were present. Detection limits for these samples were not specified. However, information was available for sample MM5 train blanks and sample train volumes making calculation of detection limits possible. The calculated detection limit for the 2378-TCDD and other TCDD isomers was 0.006 ng/m^3. For the TCDF isomers, the calculated detection limit was 0.007 ng/m^3.

3.2.13 Experimental Studies

Experimental studies have been conducted on PCDD and PCDF formation from combustion of chlorinated aromatics (see Table 3-15). Chlorobenzenes, chlorophenols and the effect of inorganic chlorine on PCDD emissions have been studied. Buser investigated the formation of PCDD's and PCDF's from the pyrolysis of chlorobenzenes.[34] Both PCDD's and PCDF's were detected in pyrolyzed samples. The formation mechanism proposed included a chlorophenol intermediate. Buser also investigated the formation of PCDF's from pyrolysis of PCB's.[35,36,37] The yields of PCDF's were estimated to range from 0.1 percent to several percent. The proposed mechanism is an intramolecular cyclization.

TABLE 3-15. SOURCE CATEGORY: EXPERIMENTAL

Type of Facility	No. of Units Tested (Location)	Sample	PCDD/PCDF Emission Concentration and Ash Sample Content						References
			2378-TCDD		PCDD		PCDF		
			Mean	Range	Mean	Range	Mean	Range	
Quartz Mini Ampule (Tri-chlorobenzene pyrolysis)	1	FG	-	-	197 ng/samp (5)[a]	45-370 ng/samp	1081 ng/samp (5)	291 - 1815	34
Pilot Incineration (Chlorophenol Treated Wood)	1	FG	-	-	24 ug/g feed (20)	0.1 - 155 ug/g feed	-	-	111
Vegetable Combustion (Vegetables + Cl)	1	FG	-	-	36 ug/g feed	2 - 101 ug/g feed	31 ug/g feed (8)	6 - 74 ug/g feed	145
Quartz tube (Coal + Air + HCl)	1	FG	-	-	103 ng/g feed (4)	1.2 - 290	-	-	149
Chlorophenol Combustion	1	FG	-	-	307 ug/g feed[b] (49)	0.6 - 3400 ug/g feed	-	-	200

" - " means no data

[a] Numbers in parenthesis indicate number of samples calculations are based on.

[b] PCDD/PCDF data combined.

In a pilot incineration study, Jansson combusted chlorophenol-treated wood.[111] PCDD's were detected at levels ranging from 0.2-155 ug/g feed.

Three reports have dealt with PCDD formation from combustion processes in the presence of inorganic chlorine.[145,149,226] Tiernan et al. found no detectable PCDD's or PCDF's emitted from the combustion of virgin pine.[226] However, in the presence of HCl, significant quantities of TCDD's were detected. Mahle et al. present similar results when burning coal in the presence of Cl_2, HCl, and NaCl.[149] Liberati et al. studied the combustion of vegetables.[145] When inorganic chlorine or polyvinyl chloride (PVC) is added, PCDD's and PCDF's were detected in the emissions.

Chlorophenol combustion was studied at various combustion temperatures and residence times by Environment Canada.[200] Combustion of 2,4,5-TCP, Alchem 4135, Woodbrite 24, and diptank sludge generated from Woodbrite 24 preservation, resulted in PCDD concentrations in flue gas ranging from 0.6-3400 ug/g feed.

3.3 PCDD FORMATION HYPOTHESES AND FACTORS AFFECTING EMISSIONS FOR COMBUSTION SOURCES

This section presents a summary of the most common PCDD formation hypotheses for PCDD emissions from combustion sources. The section summarizes the hypotheses contained in the literature and also presents a discussion of combustion device operating parameters and fuel characteristics that may affect PCDD emissions.

3.3.1 A Summary of Formation Hypotheses for PCDD From Combustion

One of the earliest combustion device PCDD formation hypotheses advanced was that of Dow Chemical Company entitled "The Trace Chemistries of Fire--A Source of and Routes for the Entry of Chlorinated Dioxins into the Environment."[31,62] This hypothesis was advanced based on sampling conducted by Dow Chemical Company from samples taken around the Midland facility and sampling of a wide range of combustion devices.

This hypothesis suggested that PCDD's/PCDF's in combustion effluents were ubiquitous and were due to the trace chemistries of fire. This hypothesis, in conjunction with the findings of PCDD/PCDF in ashes and stack gases from municipal solid waste combustors, lead to the inclusion of combustion sources in the National Dioxin Study.

A significant amount of effort has been expended to attempt to explain how or why PCDD's/PCDF's are formed in combustion processes. Table 3-16 summarizes hypotheses contained in the literature. Much of the effort has been directed toward municipal solid waste incinerators. A significant number of studies and hypotheses have tried to link specific precursors with PCDD formation. The most prevalent precursors cited include chlorinated phenols and chlorobenzenes. A considerable amount of work has also focused on the chlorine content of the fuel. None of the hypotheses advanced to date have been proven.

3.3.2 Factors Affecting PCDD Emissions From Combustion Sources

This section discusses the various factors identified in the literature that may effect PCDD emissions. The following factors are believed to affect CDD emissions:

- PCDD in feed,
- precursors in feed,
- chlorine in feed,
- combustion temperature,
- residence time,
- oxygen availability,
- feed processing, and
- supplemental fuel.

The interaction of these factors during the formation of PCDD's is not well defined. Therefore, each of the factors is discussed separately below.

3.3.2.1 PCDD in Feed. 2378-TCDD is an impurity that results from the manufacture of trichlorophenol, which is used to make the herbicide 2,4,5-trichlorophenoxy acetic acid (245-T). Pentachlorophenol (PCP) production will also result in a PCDD contaminant, primarily octachlorodibenzo-p-dioxin (OCDD). The primary end use for PCP is as a wood preservative. It is anticipated that limited PCDD contamination will also occur during the manufacturing of other similar chlorinated aromatics, particularly if the manufacturing process is inefficient or not well controlled. Therefore,

Table 3-16. Summary of PCDD/PCDF Formation Hypotheses

Dioxin Formation Hypothesis/Author	Source Categories or Fuels Under Consideration	Key Variables or Factors Affecting Dioxin Formation and Emission	Data Base References
Trace Chemistries of Fire Bumb, Crummett	All Combustion Sources	Numerous chemical reactions o Combustion seldom more than 99.9% efficient o Refuse and fossil fuels are complex o Natural chlorine content; 1-5000 ppm o Transition metals in ash o Chlorinated phenols and chlorobenzenes	31
Shih et al.	Fossil Fuels, wood, coal, refuse in utility, industrial and commercial boilers	Molecular structure of fuel Chlorine content Presence of precursors Combustion conditions: o temperature, residence time Mixing efficiency and air/fuel ratio	210
Precursor Hypothesis Esposito, et al.	Combustion of Wastes	Precursors: chlorophenols, chlorobenzenes, PCB's	78
Rappe, et al. Jansson, et al. Ahling, et al.	Experimental studies; Combustion of chlorinated phenols	Combustion temperature o 500-800°F	190, 111, 6, 7
Buser, et al.	Pyrolysis of Chlorobenzenes Pyrolysis of PCB's		34 36
Tiernan, et al.	Wood	Addition of HCl	226
Mahle and Whiting	Coal	Inorganic Chlorine: Cl_2, HCl, NaCl	149
Liberati, et al.	Vegetables	Addition of inorganic chlorine or PVC	145
Post flame catalytic reactions Shaub	Municipal Solid Waste	Availability of active sites on particulate Temperature (above 1400°F) Chlorination of lignin on grate Uniform temperature & mixing with combustion air	207
"New Theory" Griffin	Municipal Solid Waste/Coal Combustion	Chlorine to sulfur ratio Chlorination of aromatic rings via Cl_2 gas	--
Commoner, et al. Gas phase synthesis after combustion	Municipal Solid Waste	Availability of Cl_2 derived from PVC Oxidative Combustion Processes	48
Niessen	Municipal Solid Waste	HCl from oxidation of PVC Unchlorinated precursor: lignin Chlorination of precursor in gas flow path above grate	170

PCDD's are expected to enter the environment as a contaminant of commercial products, such as wood preservatives and pesticides.

The widespread use of these products increases the possibility of finding PCDD's in the feed of a combustion process. For example, PCP-treated wood may be used to fire boilers. Runoff may carry pesticides to water treatment facilities where the organics are incorporated into a sludge. The sludge may then be incinerated. Likewise, contaminated waste streams from manufacturing processes may be incinerated as an energy recovery procedure. One example is PCP sludge incinerators used at wood preserving facilities.

If PCDD's are found in the feed of an inefficient or poorly controlled combustion process, it is very likely that they will be released to the atmosphere.

3.3.2.2 Precursors in Feed. Although the Dow "Chemistry of Fire" theory is backed by a considerable amount of experimental data, many of the reviewed studies focused on the formation of PCDD's and PCDF's from precursors. Experiments by Buser, Rappe, and others are described in more detail in Section 3.2.11. Esposito et al. presented detailed descriptions of the formation mechanisms of chlorinated CDD's from precursors.[78] This work organizes CDD precursors into three classes:

Class I - Polyhalogenated phenols, primarily with a halogen ortho to the hydroxyl group, with a high probability of CDD formation.

Class II - Ortho-halophenols and ortho-halophenyl esters where the substituted groups are a mixture of halogens and nonhalogens.

Class III - Other chemicals having the possibility, but less likelihood, of CDD formation. These include chlorinated aromatic compounds.

The majority of experimental work to date has centered on three classes of precursors: chlorinated phenols, chlorinated benzenes, and PCB's.

PCDD formation from the combustion of chlorinated phenols has been tested extensively by Rappe[190], Jansson[111], and Ahling[6,7]. Dechlorination of the highly chlorinated homologues can result in the more toxic TCDD isomers. Chlorinated phenols are used as wood preservatives, herbicides, and sap stain control. Wood or vegetation sprayed with chlorophenols may be disposed of by incineration or used as a supplemental fuel in boilers. In addition, chlorophenol, i.e., wastes, have the potential to be disposed of in sludge incinerators and industrial boilers.

Buser investigated the formation of PCDD's and PCDF's from the pyrolysis of chlorobenzenes.[34] The formation mechanism included a chlorophenol and a polychlorinated diphenyl ester (PCDPE) intermediate. Chlorobenzenes are used in solvents, dyes, pharmaceuticals, and rubber production. These products make up much of the organic chlorine found in feed of municipal waste incinerators. The associated waste product may also be disposed of in an incinerator or boiler.

Buser also investigated the formation of PCDF's from the pyrolysis of PCB's.[34,35,36] No experimental work has been identified on PCDD formation from PCB's. However, studies have been identified that found PCDD's emitted from PCB fires.[60,158] In addition, PCB's are often in solution with hexachlorobenzenes that have been shown to form PCDD's. Up until 1975, PCB's were used as dielectric fluids in transformers and capacitors. PCB's have also been used in hydraulic fluids, plasticizers, and dyes. The incineration of PCB's at waste disposal facilities or in boilers may result in PCDD and PCDF emissions.

3.3.2.3 Chlorine in Feed. The chlorine content of fuel is obviously an important parameter affecting the formation of PCDD's or PCDF's. Shih et al. developed a ranked priority list of conventional combustion systems emitting polycyclic organic matter including PCDD's and PCDF's.[211] The rationale presented for source ranking is based on fuel characteristics and combustion conditions. Shih's work places great emphasis on both the chlorine content of the feed and the concentration of aromatics in the feed.

Other authors have demonstrated the effect of chlorine on PCDD emissions. Mahle et al. demonstrated that PCDD's were emitted from coal combustion only when chlorine was added.[149] Tiernan et al. found PCDD formation during the combustion of pine in the presence of HCl, but no PCDD's were detected during the combustion of pine alone.[226] Liberti studied the combustion of vegetables.[145] When inorganic chlorine or PVC is added, PCDD's and PCDF's were detected in the ash.

While the precursor theory has received widespread acceptance, these inorganic chlorine studies demonstrate that the specific mechanisms involved in PCDD formation are complex and not well understood. However, it can be generally stated that chlorine must be present for the formation of PCDD, and general trends indicate that increased chlorine concentrations in the feed improve the possibilities of PCDD emissions.

3.3.2.4 Combustion Conditions. The remaining factors identified in the literature that affect PCDD emissions are combustion conditions. These include combustion temperature, residence time, supplemental fuel, fuel processing, and oxygen availability. Combustion efficiency is a function of all of these factors. In order to destroy PCDD's or prevent their formation, the combustion efficiency must be high. This requires a combination of high temperatures, available oxygen, high heating value fuel, and long residence times.

3.3.2.5 Combustion Temperature. Experimental evidence suggests that temperatures of 500-800°C promote PCDD formation, while temperatures greater than 800°C destroy PCDD's.[6,37,62] Buser et al. showed that PCB pyrolysis at 550 to 650°C forms PCDF.[192] However, pyrolysis at temperature greater than 700°C causes 99 percent destruction of PCB's and no PCDF formation. Ahling et al. produced similar results for both PCDD's and PCDF's during the combustion of chlorophenols.[7]

Combustion temperature is a function of the heating value of the fuel or supplemental fuel, the available air, and the degree of fuel processing. Municipal waste incinerators are considered a major combustion source of PCDD's.[228] The large mass burn units are characterized by low combustion temperatures. This is due in part to the high moisture, low heating value fuel, poor air/feed mixing as a result of a lack of feed processing, and lack of supplemental fuel. In comparison, many hazardous waste incinerators and high efficiency boilers are designed for efficient combustion. These units burn high heating value fuels or add high heating value supplemental fuels and, even if the air/fuel ratio is low, the air/fuel mixing is efficient. The fuels are processed to decrease moisture and improve mixing. In many cases, high temperature afterburners are used for the combustion of offgases.

Several studies have been identified that demonstrate the effects of high combustion temperatures on PCDD's and PCDD precursors.[3,184,234] For example, no PCDD's were detected in the emissions of the Vulcanus incinerator ship during the combustion of PCDD contaminated Herbicide Orange.[3] The combustion temperature during this study was 1600°C.

3.3.2.6 Residence Time. The residence time necessary to destroy PCDD's and the combustion temperature are inversely related. The higher the combustion temperature, the shorter the required residence time for PCDD destruction. Likewise, a low temperature source will require a long residence time for destruction of PCDD's. Sachdev *et al*. showed that an increase in both temperature and residence time decreased the formation of PCDD's from chlorophenol combustion.[200] Similar results have been found at hazardous waste incinerators that run with 1.5-2.0 second residence times. Combustion sources with longer residence times and high temperatures are less likely to form products of incomplete combustion, such as PCDD's.

3.3.2.7 Oxygen Availability. Oxygen availability is a function of both the air/fuel ratio and air/fuel mixing efficiency, both of which are of concern when burning solid fuels. Solid fuels and high viscosity liquid fuels such as waste tars burn as particulates or large droplets; therefore, portions of the fuel are burned in low oxygen or pyrolysis conditions. An insufficient supply of oxygen or poor air/fuel mixing will promote poor combustion conditions and PCDD formation. Jansson demonstrated that an insufficient air supply increases PCDD emissions from chlorophenol combustion.[111] Municipal waste incinerators are usually fired with excess air. However, large mass burn units may have poor air/fuel mixing due to the lack of fuel processing or poorly designed air distribution systems. Activated carbon regeneration and wire reclamation incinerators are both designed to be operated with low excess air. All of these cases have been shown to emit CDD's.[100,102,103]

3.3.2.8 Feed Processing. The feed material for a combustion source may be a liquid, a solid, or a gas. Both liquid and gas fuels can be easily mixed with air resulting in a high combustion efficiency; solid feeds usually require some processing to improve combustion. Often solid feeds require drying, shredding, or separation to improve combustion. Similarly, high viscosity fuels (i.e., waste tars) require preparations such as preheating and atomization prior to combustion.

Feed processing will determine in part both oxygen availability and residence time. Fine, homogeneous feed particles will improve air/fuel mixing and combustion. Larger particles will require longer residence times and may result in local oxygen deficiencies due to poor mixing. High moisture will also decrease combustion efficiency. Therefore, highly processed homogeneous feeds are less likely to emit products of incomplete combustion, such as PCDD's.

3.3.2.9 Supplemental Fuel. When burning a low Btu fuel, the addition of supplemental fuel will increase the combustion temperature and improve combustion. Haile et al. tested a boiler cofiring RDF with coal.[92] The boiler temperature was 1200°C, and no PCDD's were detected. Dow Chemical tested an industrial incinerator burning waste tars without supplemental fuel and found ppb levels of TCDD's in the fly ash.[62] After the addition of a supplemental fuel, no TCDD's were detected.

APPENDIX A

LIST OF REFERENCES PERTAINING TO CHLORINATED DIOXIN AND FURAN AIR EMISSIONS

LIST OF REFERENCES PERTAINING TO CHLORINATED DIOXIN AND FURAN AIR EMISSIONS

*Denotes draft or unpublished reports from which emissions data were available.

1. Ackerman, D. G., et al. (TRW, Inc.) At-Sea Incineration of Herbicide Orange Onboard the M/T Vulcanus. EPA-600/2-78-086. April 1978.

2. Ackerman, D. G., et al. (TRW, Inc.) At-Sea Incineration of PCB Containing Wastes Onboard the M/T Vulvanus." (Prepared for U. S. Environmental Protection Agency, Office of Water) EPA600-7-83-024, April 1983.

3. Ackerman, D. G. (TRW, Inc.) Destruction Efficiencies for TCDD During At-Sea Incineration of Herbicide Orange. (Prepared for the Industrial Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Research Triangle Park), Contract No. 68-02-2660, March 1979.

4. Addis, G. and R.Y. Komai, eds. Proceedings: 1983 PCB Seminar. EPRI EL-3581, Electric Power Research Institute, Palo Alto, Ca. June 1984. 520 pp.

5. Ahlberg, M. et al. Chemical and Biological Characterization of Emissions from Coal and Oil-Fired Power Plants. Environmental Health Perspectives. 47: 85-102. 1983.

6. Ahling, B. and A. Lindskog. Emission of Chlorinated Organic Substances from Combustion: Chlorinated Dioxins and Related Compounds Impact on the Environment. O. Hutzinger, R.W. Frei, E. Merian, F. Pocchiari (eds). Pergamon Press, Ltd. 1982, pp. 215-225.

7. Ahling, B., et al. Formation of Polychlorinated Dibenzo-p-dioxins and Dibenzofurans During Combustion of a 2,4,5-T Formulation. Chemosphere. Volume 6, 1977. pp. 461-468.

8. Alsberg, T., et al. Chemical and Biological Characterization of Organic Material from Gasoline Exhaust Particles. Environmental Science Technology, Vol 19, No. 1, 1985.

9. Arsenault, R. D. Pentachlorophenol and Chlorinated Dibenzodioxins in the Environment - A Study of Environmental Fate, Stability, and Significance When Used in Wood Preservation. Proceedings of the American Wood Preserving Association. Volume 72, 1976, pp. 122-148.

10. (ASME) Study on State-of-the-Art of Dioxin from Combustion Sources. (Prepared by Arthur D. Little, Inc.) 1981.

11. Ballschmiter, K., W. Zoller, C. Scholz, and A. Nottrodt. Occurrence and Absence of Polychlorodibenzofurans and Polychlorodibenzodioxins in Fly Ash from Municipal Incinerators. Chemosphere, Vol. 12, No. 4/5, pp. 585-594, 1983.

12. Ballschmiter, K., et al. Occurrence and Absence of Polychlorodibenzofurans and Polychlorodibenzodioxins in Fly Ash from Municipal Incinerators. Paper Presented at the 3rd International Symposium on Chlorinated Dioxins and Related Compounds. Salzburg, Austria, October 12-14, 1982.

13. (Battelle Columbus Division.) Determination of Dioxin Levels in Carbon Reactivation Process Effluent Streams. EPA Contract No. 68-02-3487. January 1984.

14. Barnes, D. G. Assessing TCDD Emissions from Municipal Waste Combustors. Presented at the 3rd International Symposium on Chlorinated Dioxins and Related Compounds. Salzburg, Austria, October 12-14, 1982.

15. Barnes, D. G. Assessing TCDD Emissions from Municipa Waste Combustors. Chemosphere Vol. 12, No. 4/5, 1983, pp. 645-655.

16. Barnes, D. G. Dioxin Production from Combustion of Biomass and Wastes. (Presented at the "Symposium on Energy From Biomass and Wastes VII," by The Institute of Gas Technology) Lake Buena Vista, Florida, January 24-28, 1983.

17. Barnes, D.G. Possible Consequences of Sharing An Environment with Dioxins. Accidental Exposure to Dioxins: Human Health Aspects. F. Coulston and F. Pocchiari (eds). Academic Press, 1983, pp. 259-266.

18. Benfenati, E., et al. Polychlorinated Dibenzo-p-dioxins (PCDD) and Polychlorinated Dibenzofurans (PCDF) in Emissions from an Urban Incinerator, 2. Correlation Between Concentration of Micropollutants and Combustion Conditions. Chemosphere. 1982. (Volume No. 12, No 9/10).

19. Boddington, M. J., Douglas V. M., Duncan C. E., Gilbertson M., Grant D. L., Hallett D., McClelland L., Roberts J. R., Singh J., Whittle, M. Dioxins in Canada. Chemosphere. Vol. 12, No. 4/5, pp. 477-480, 1983.

20. Bond, D. H. At-Sea Incineration of Hazardous Wastes. Environmental Science Technology, Vol. 18, Nov. 5, 1984. pp. 148A-152A.

20a. Branscome, M. et al. Evaluation of Waste Combustion in a Wet-Process Cement Kiln at General Portland, Inc., Paulding, Ohio. EPA Contract No. 68-02-3149. February 1985.

20b. Branscome, M. et. al. Evaluation of Waste Combustion in a Dry-Process Cement Kiln at Lone Star Industries, Oglesby, Illinois. EPA Contract No. 68-02-3149. December 1984.

21. Brenner, K. S. et al. Dioxin Analysis in Stack Emissions and in the Wash Water Circuit During High-Temperature Incineration of Chlorine-Containing Industrial Wastes. Bull. Environ. Contamin. Toxicol. 33: 153-162. 1984.

22. Bridle, T.R., et al. The Formation and Fate of PCDD's and PCDF's During Chlorophenol Combustion. For presentation at the 77th annual meeting of the Air Pollution Control Association. San Francisco, California. June 24-29, 1984.

23. Bridle, T. R. Assessment of Organic Emissions from the Hamilton Sewage Sludge Incinerator. Environment Canada, Environmental Protection Service, Wastewater Technology Centre, Ontario.

24. Brocco, D. et al. Evaluation of the Organochlorine Compounds in the Biological Sludges and in the Products of Transformation. Annali di Chimica 74, 1984. pp. 573-578.

25. Brocco, D. et al. Interlaboratory Sampling and Analysis of PCDD's and PCDF's in Emissions from Urban Incinerators. Chemosphere 13 (12): 1319-1328, 1984.

26. Brocco, D., et al. Polychlorodibenzodioxins and polychlorodibenzofurans in the Environment. Physico-Chemical Behavior of Atmospheric Pollutants. (Proceedings of the Second European Symposium, Varese, Italy, September 29 - October 1, 1981.) B. Versino and H. Ott, ed. 1981. pp. 82-88.

27. Brooks, C., compiler. Energy from Municipal Waste Research: A Technical Review of Thermochemical Systems-Workshop Proceedings. ANL/CNSV-TM-144, Argonne National Laboratory, Argonne, IL. September 1984. 331 pp.

28. Brooks, G. W. (Radian Corp.) Summary of a Literature Search to Develop Information on Sources of Chlorinated Dioxin and Duran Air Emissions. Final Report. Prepared for Strategies and Air Standards Division, U. S. Environmental Protection Agency, October 1983.

29. Bronzetti, G., Bauer, C., Corsi, C., DelCarratore, R., Nieri, R., Paolini, M., Mutagenicity Study of TCDD and Ashes from Urban Incinerator "In Vitro" and "In Vivo" Using Yeast D7 Strain. Chemosphere, Vol. 12, No. 4/5, pp 549-553, 1983.

30. (Browning-Ferris Industries, Inc.) Executive Summary: Dioxins and Waste-to-Energy Plants. July 1982.

31. Bumb, R. R., et al. (Dow Chemical) Trace Chemistries of Fire: A Source of Chlorinated Dioxins. Science. Volume 210. October 1980. pp. 383-391.

31a. Bumbaco, M. J. Report on a Stack Sampling Program to Measure the Emissions of Selected Trace Organic Compounds, Particulates, Heavy Metals, and HCl From the Royal Jubilee Hospital Incinerator, Victoria, B.C. Pollution Measurement Division, Environmental Protection Programs Directorate, Ottawa, Ontario. April 1983.

32. Bureau of Air Toxics, Division of Air Preliminary Report on Sheridan Avenue RDF Plant. "Answers". January 28, 1985.

33. Buser, H. R., et al. Identification of Polychlorinated Dibenzo-p-dioxin Isomers Found in Fly Ash. Chemosphere. Volume 7, 1978. pp. 165-172.

34. Buser, H. R. Formation of Polychlorinated Dibenzo-p-dioxins (PCDDs) and Dibenzofurans (PCDFs) from the Pyrolysis of Chlorobenzenes. Chemosphere. Volume 8. 1979. pp. 415-424.

35. Buser, H. R., et al. Identification of Polychlorinated Dibenzofuran Isomers in Fly Ash and PCB Pyrolyses. Chemosphere. Volume 7, 1978. pp. 419-429.

36. Buser, H. R., et al. Formation of Polychlorinated Dibenzofurans (PCDFs) from the Pyrolysis of PCB's. Chemosphere. Volume 7, 1978. pp. 109-119.

37. Buser, H. R. and C. Rappe. Formation of Polychlorinated Dibenzofurans from the Pyrolysis of Individual PCB Isomers. Chemosphere. Volume 8, 1979. pp. 157-174.

38. Buser, H.R. and C. Rappe. Isomer-specific Separation of 2378-Substituted Polychlorinated Dibenzo-p-dioxins by High Resolution Gas Chromatography/Mass Spectrometry. Anal. Chem. 1984, 56, pp. 442-448.

39. Cassitto, L. and P. Magnani. 2,3,7,8-TCDD Monitoring in Flue Gases from an Incinerating Plant. Recent Developments in Mass Spectrometry in Biochemistry and Medicine. (Proceedings of the 4th International Symposium.) Alberto Frigerio, ed. Volume 1, 1978. pp. 563-568.

40. Castaldini, C. Dioxin Emission from Industrial Boilers Burning Hazardous Materials. EPA Contract No. 68-03-3241. February 1985.

41. Castaldini, C., et al. (Acurex Corporation). Emissions Testing of Industrial Boilers Cofiring Hazardous Wastes - Sites A, D, E, G. (Prepared for U.S. Environmental Protection Agency, IERL, Cincinnati), 1983.

42. Cavallaro, A., et al. Sampling, Occurrence, and Evaluation of PCDDs and PCDFs from Incinerated Solid Urban Waste. Chemosphere. Volume 9, 1980. pp. 611-621.

43. Cavallaro, A., et al. Summary of Results of PCDD Analyses from Incinerator Effluents. Chemosphere, Volume 11, No. 9, 1982, pp. 859-868.

44. Chin, C. et al. Polychlorinated Hydrocarbons from Power Plants, Wood Burning, and Municipal Incinerators. Chemosphere 12: 607-616, 1983.

45. Choudhry, G., et al. Mechanisms in the Thermal Formation of Chlorinated Compounds Including Polychlorinated Dibenzo-p-dioxins. Proceedings of Workshop held at Instituto Superior de Fanita, Rome, Italy, October 1980.

46. Choudry, G. G. and O. Hutzinger. Mechanistic Aspects of The Thermal Formation of Halogenated Organic Compounds Including Polychlorinated Dibenzo-p-Dioxins. Gordon and Breach Science Publishers. Chapter 6.

47. Clement, R. E., A. C. Viau, and F. W. Karasek. Daily Variations in Composition of Extractable Organic Compounds in Fly-Ash from Municipal Waste Incinerators.

48. Commoner B., T. Webster, K. Shapiro, and M. McNamara. The Origins and Methods of Controlling Polychlorinated Dibenzo-p-Dioxin and Dibenzofuran Emissions from MSW Incinerators. For Presentation at: Air Pollution Control Association Annual Meeting, Detroit, Mich. June 20, 1985. Center for the Biology of Natural Systems, Queens College.

49. (Concord Scientific Corporation.) National Incinerator Testing and Evaluation Program (NITEP) Volume 4: Detailed Results. A Report to Environment Canada. June 1985.

50. Cooke, M. et al. Candidate Sampling and Analysis Methods for Twenty-One Suspect Carcinogens in Combustion Emissions. For Presentation at the 77th Annual Meeting of the Air Pollution Control Association, San Francisco, Calif. June 24-29, 1984.

51. (Cooper Engineers, Inc.) Air Emissions and Performance Testing of a Dry Scrubber (Quench Reactor), Dry Venturi and Fabric Filter System Operating on Flue Gas from Combustion of Municipal Solid Waste at Tsushima, Japan. West County Agency of Contra Costa County Waste Co. - Disposal/Energy Recovery Project. August 1984.

52. Coulston F., and F. Pacchiari, eds. Accidental Exposure to Dioxins, Human Health Aspects. Academic Press 1983.

53. Crosby, D. G. and A. S. Wong. Photochemical Generation of Chlorinated Dioxins. Chemosphere. Volume 5, 1976. p. 327.

54. Crummett, W. B., T.J. Nestrick, and L.L. Lamparski. Advanced/Good Analytical Techniques Elaborated on the Detection of Polychlorinated Dibenzodioxins in Environmental Samples.

55. Crummett, W. B. (Dow Chemical). Environmental Chlorinated Dioxins from Combustion - The Trace Chemistries of Fire Hypothesis. From Pergamon Series on Environmental Science Volume 5 - Chlorinated Dioxins and Related Compounds Impact on the Environment. 1982. pp. 253-263.

56. Czuczwa, J.M. and R. A. Hites. Environmental Fate of Combustion-generated Polychlorinated Dioxins and Furans. Environmental Science Technology, Vol. 18, No. 6, 1984.

57. DaRos, B., et al. (Acurex Corporation) Measured Multimedia Emissions from the Wood Preserving Industry. (Prepared for U.S. Environmental Protection Agency, Cincinnati, Ohio) Contract No. 68-03-2567, Task 4028. March 1981.

58. Dawson G. W., J. M. Meuser, M. C. Lilga, Dioxin Transport From Contaminated Sites To Exposure Locations: A Methodology for Calculating Conversion Factors. January 1985. Prepared for EPA.

58a. Day, D. R., L. A. Cox, and R. E. Mournighan. Evaluation of Hazardous Waste Incineration in a Lime Kiln: Rockwell Lime Company. EPA-600/S2-84-132. November 1984.

59. DeRoos, F. L. and A. Bjorseth. (Battelle-Columbus) TCDD Analysis of Fly Ash Sample. (Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC) EPA Contract No. 68-02-2686, Task 113. June 15, 1979.

60. des Rosiers, P. E. PCBs, PCDFs, and PCDDs Resulting from Transformer/Capacitor Fires: An Overview. From: Proceedings: 1983 PCB Seminar. Research Project 2028, Electric Power Research Institute, Palo Alto, Ca., June 1984.

61. des Rosiers, P. E. Remedial Measures for Wastes Containing Polychlorinated Dibenzo-p-dioxins (PCDDs) and Dibenzofurans (PCDFs): Destruction, Containment, or Process Modification. British Occupational Hygiene Society, Vol. 27, No. 1, pp 57-72, 1983.

62. (Dow Chemical) The Trace Chemistries of Fire - A Source of and Routes for the Entry of Chlorinated Dioxins into the Environment. The Chlorinated Dioxin Task Force, the Michigan Division of Dow Chemical U.S.A. 1978.

62a. Doyle, B. W., D. A. Drum, and J. D. Lauber. The Smoldering Question of Hospital Wastes. Pollution Engineering. 17(7), July 1985. pp. 35-39.

63. Dioxins. Industrial Environmental Research Laboratory, Cincinnati, OH. Nov. 80. EPA 600/2-80-197.

64. Dryden, F. E., et al. (Walk, Hayde, & Associates). Dioxins: Volume III - Assessment of Dioxin-Forming Chemical Processes. (Prepared for the U.S. Environmental Protection Agency. Cincinnati, Ohio). EPA-600/2-80-158. June 1980.

65. Duckett, E. J. Dioxins in Perspective: Knowns, Unknowns, Resolving the Issues. Solid Wastes Management. May 1981. pp. 56-57, 88-89.

66. Dykes, R. M. (Radian Corp.) A Review of Standards of Performance for New Stationary Sources - Sewage Sludge Incinerators. (Prepared for Environmental Protection Agency, Emissions Standards and Engineering Division) EPA Contract No. 68-02-3816, January 1984.

67. Eiceman, G. A. and H. O. Rghei. Chlorination reactions of 1,2,3,4-Tetrachlorodibenzo-p-dioxin on fly ash with HCl in air. Chemosphere, Vol. II, No. 9, pp. 833-839, 1982.

68. Eiceman, G. A. and H. O. Rghei. Presence of Nitro-chlorinated Dioxins on Fly Ash from Municipal Incinerators and From Laboratory Production Through Reactions Between NO_2 and T_4CDD on Fly Ash. Chemosphere, Vol. 13, No. 9, pp. 1025-1032, 1984.

69. Eiceman, G. A., et al. Variations in Concentrations of Organic Compounds Including Polychlorinated Dibenzo-p-dioxins and Polynuclear Aromatic Hydrocarbons in Fly Ash from a Municipal Incinerator. Analytical Chemistry. Volume 53, 1981. pp. 955-959.

70. Eiceman, G. A., et al. Ultrasonic Extraction of Polychlorinated Dibenzo-p-dioxins and Other Organic Compounds from Fly Ash from Municipal Incinerators. Analytical Chemistry. Volume 52, 1980. pp. 1492-1496.

71. Eiceman, G. A., et al. Analysis of Fly Ash from Municipal Incinerators for Trace Organic Compounds. Analytical Chemistry. Volume 51, 1979. pp. 2343-2350.

72. Eklund G., and B. Stromberg. Detection of Polychlorinated Polynuclear Aromatics in Flue Gases from Coal Combustion and Refuse Incinerators. Chemosphere, Vol. 12, No. 4/5, pp. 657-660, 1983.

73. (Environment Canada), Report of the Ministers' Expert Advisory Committee on Dioxins, November 1983.

74. EPA Letter from Anita J. Frankel, to Bob Courson, Dana Davoli, RE:
* Dioxin and Furans in Ross Electric at Logan Hill Incinerator Ash. Jan. 15, 1985.

75. EPA Memorandum from: J. P. O'Connor to Dr. Robert M. Clark. RE: Risk Assessment on Preliminary Dioxin Data for Cincinnati Carbon Regeneration Plant. May 10, 1985.

76. EPRI CS 3308. State-of-the-Art Review: PCDDs and PCDFs in Utility PCB Fluid. November 1983.

77. Erickson, M. D. et al. Thermal Degradation Products from Dielectric Fluids. EPA-560/5-84-009, U.S. Environmental Protection Agency, Washington, D.C. December 1984. 91 pp.

78. Esposito, M. P., et al. (PedCo Environmental). Dioxins: Volume I - Sources, Exposure, Transport, and Control. (Prepared for the U.S. Environmental Protection Agency, Cincinnati, Ohio). EPA-600/2-80-156. June 1980.

79. Esposito, M. P. and D. R. Watkins. Airborne Dioxins: The Problem in Review. Paper Presented at the 73rd Annual Meeting of the Air Pollution Control Association. Montreal, Quebec. June 22-27, 1980.

80. Feeney, A. and J. Jubak. Dow and Dirty. Environ. Action, Volume 14, November 9, 1983.

81. * Fennelly, P. F., et al. Environmental Characterization of Disposal of Waste Oils in Small Combustors. (Draft) U.S. Environmental Protection Agency, Contract No. 68-02-3168. August 1983.

82. Fishbein, L. Trace Organic Contaminants in the Environmental Chlorinated Dioxins and Dibenzofurans. International Journal of Ecology and Environmental Sciences. Volume 2, 1976. pp. 69-81.

83. (Fred C. Hart, Associates). Assessment of Potential Public Health Impacts Associated with Predicted Emission of Polychlorinated Dibenzo-Dioxins and Polychlorinated Dibenzo-Furans from the Brooklyn Navy Yard Resource Recovery Facility. Prepared for New York City Department of Sanitation. August 17, 1984. 387 pp.

84. (Fred C. Hart, Associates). Conclusions of New York's Study on Dioxins and MSW Incineration. Waste Age V. 15, No. 11, 1984.

85. (Fred C. Hart, Associates). Impact of Burning Hazardous Waste in Boilers. Prepared for SCA Chemical Services, Inc., August 1982.

86. Frounfelker, R. (Systech), A Technical, Environmental, and Economic Evaluation of Small Modular Incinerator Systems with Heat Recovery, (Prepared for U.S. Environmental Protection Agency, Office of Solid Waste and the California State Waste Management Board), 1979.

87. Gizzi, F., et al. Polychlorinated Dibenzo-p-dioxins (PCDD) and Polychlorinated Dibenzofurans (PCDF) in Emissions from an Urban Incinerator - 1. Average and Peak Values. Chemosphere. Volume 11, 1982, pp. 577-583.

88. Gorman, P. G., G. J. Hennon and G. S. Kush. Summary of Trial Burn Results at the SCA Incinerator. For Presentation at the 77th Annual Meeting of the Air Pollution Control Association. San Francisco, Ca. June 24-29, 1984.

89. Graham, S. J. et al. Production of Polychlorinated Dibenzo-p-Dioxins (PCDD) and Dibenzofurans (PCDF) from Resource Recovery Facilities - Part I. Sources, Emissions and Air Quality Standards. Presented at the 1984 National Waste Processing Conference - Engineering: The Solution, Orlando, Fla., June 3-6, 1984. pp. 345-376.

90. Gross, M. L. et al. Analysis of Tetrachlorodibenzodioxins and Tetrachlorodibenzofurans in Fly Ash and Bottom Ash. Department of Chemistry, University of Nebraska, Lincoln, N.E.

91. Gschwandtner, G. et al. Sensitivity Analysis of Dispersion Models for Point and Area Sources, JAPCA, Volume 32, No. 10, October 1982.

92. Haile, C. et al (MRI). Assessment of Emissions of Specific Compounds from a Resource Recovery Municipal Refuse Incinerator. 1984. EPA 560/5-84-002.

93. Haile, C. L., et al. (MRI) Comprehensive Assessment of the Specific Compounds Present in Combustion Processes. Volume 3, National Survey of Organic Emissions from Coal Fired Utility Boiler Plants, Vol. 1, EPA-560/5-83-006, September 1983.

94. Haile, C.L., et al. Emissions of Organic Pollutants from Coal-Fired Utility Boiler Plants: Identification and Analysis of Organic Pollutants in Air. L.H. Keith (ed). Butterwork Publishers, 1984, pp. 443-458.

95. Hall, J. et al (GCA Corp.). Evaluation of PCB Destruction Efficiency in an Industrial Boiler. (Prepared for IERL, U.S. Environmental Protection Agency) April 1981.

96. Hall, J. M., et al (GCA Corp.). Evaluation of the PCB Thermal Disposal
* Process in Unit 3 Boiler at Northeast Utilities' Middletown Station. Draft Final Report, (Prepared for Northeast Utilities, Hartford, Connecticut). GCA-TR-81-82-G.

97. Harless, R. L. and R. G. Lewis. Quantitative Determination of 2,3,7,8-TCDD Residues by GC/MS. U.S. Environmental Protection Agency, Health Effects Research Laboratory, Research Triangle Park, NC, 1982.

98. Harless, R. L. High Resolution Mass Spectrometry Methods of Analysis for Chlorinated Dibenzo-p-dioxins and Dibenzofurans. Human and Environmental Risks of Chlorinated Dioxins and Related Compounds. Plenum Publishing, 1983.

99. Health Hazard Evaluation Report. HETA 82-224-1336. NIOSH Investigators: Stanley Salisbury I.H. Miami Fire Dept. Miami, Fla., July 1983.

100. Higgins, G. H. (Systech Corporation) An Evaluation of Trace Organic Emissions from Refuse Thermal Processing Facilities. (Prepared for U.S. Environmental Protection Agency, Washington, D.C.) Contract No. 68-01-6071. July 1982.

101. Howes, J. E., Jr. et al. Characterization of Stack Emissions from Municipal Refuse-to-Energy Systems. EPA Contract No. 68-02-3458.

102. Howes, J. E., et al. Determination of Dioxin Levels in Carbon Reactivation Process Effluent Streams. U.S. Environmental Protection Agency, Contract No. 68-02-3487.

103. Hryhorczuk, D. O., et al. A Wire Reclamation Incinerator as a Source of Environmental Contamination with Tetrachlorodibenzo-p-dioxins and Tetrachlorodibenzofurans. Archives of Environmental Health. Volume 36, 1981. pp. 228-234.

104. Hulman, P.B., et al. (Radian Corp.) Screening Study on Feasibility of Standards of Performance for Wood Charcoal Manufacturing, (Prepared for U.S. Environmental Protection Agency, Emissions Standards and Engineering Division, Office of Air Quality Planning and Standards), August 1978.

105. Hunter, S. C. et al. Application of Combustion Modifications to Industrial Combustion Equipment. EPA-600/7-79-015a, U.S. Environmental Protection Agency. Washington, D.C. January 1979. 550 pp.

106. Hutzinger, O. (Editor) Chlorinated Dioxin and Related Compounds Impact on the Environment. Pergamon Series on Environmental Science, Vol. 5, 1982.

107. Hutzinger, O. Urban Incinerators: Causes of Dioxins in the Environment. Presented at the Congress of La Risposta Technologica Agli Inquinamenti Chimici, Milan, Italy, September 20-22, 1984. 10 pp.

108. (IT Corporation.) Dioxin Trial Burn Data Package EPA Mobile Incineration System at the James Denney Farm Site McDowell, Missouri. EPA Contract 68-03-3069. June 21, 1985.

108a. Jacobs, L., M. Zabik, and J. Philips. Concentrations of Selected Hazardous Chemicals in Michigan Sewage Sludges and Their Impact on Land Application. Final Report. Michigan State University, East Lansing, MI. 1981.

109. Janssens, J. et al. Qualitative and Quantitative Analysis of Emissions of a Municipal Incineration Installation. Presented at CEC Physico-Chemical Behaviour of Atmospheric Pollutants, 2nd Symposium, Italy, September 1981.

110. Jansson, B. and G. Sundstrom. Formation of Polychlorinated Dibenzofurans (PCDFs) During a Fire Accident in Capacitors Containing Polychlorinated Biphenyls (PCB). From Pergamon Series on Environmental Science Volume 5 - Chlorinated Dioxins and Related Compounds Impact on the Environment. 1982. pp. 201-208.

111. Jansson, B., et al. Formation of Polychlorinated Dibenzo-p-dioxins During Combustion of Chlorophenol Formulations. The Science of the Total Environment. Volume 10, 1978, pp. 209-217.

112. Jellum, E., A.K. Thorsrud, and F. W. Karasek. Two Dimensional Electrophoresis for Determining Toxicity of Environmental Substances. Analytical Chemistry, 1983, Volume 55, pp. 2340-2344.

113. (JRB Associates). Solid Waste Data: A Compilation of Statistics on Solid Waste Management Within the United States. EPA Contract No. 68-01-6000, August 1981.

114. Josephson, J. Chlorinated Dioxins and Furans in the Environment. Environment Science Technology 17(3): 124A-129A. 1983.

115. Junk, J. A. and J. J. Richard. Dioxins Not in Effluents from Coal/Refuse Combustion. Chemosphere, Volume 10, 1981. pp. 1237-1241.

116. Karasek, F. W., et al. Distribution of PCDDs and Other Toxic Compounds Generated on Fly Ash Particulates in Municipal Incinerators. Journal of Chromatography. Volume 239, 1982, pp. 173-180.

117. Karasek, F. W. Dioxins from Garbage: Previously Unknown Source of Toxic Compounds is Being Uncovered Using Advanced Analytical Instrumentation. Canadian Research. September 1980. pp. 50-56.

118. Karasek, F. W. et al. Gas Chromatographic-Mass Spectrometric Study on the Formation of Polychlorinated Dibenzo-p-Dioxins and Polychlorobenzenes from Polyvinyl Chloride in a Municipal Incinerator. J. of Chromatography 270: 227-234. 1983.

119. Kayser, R., et al. 2,3,7,8-TCDD - Intermedia Priority Pollutant Guidance Documents. Prepared by the Office of Toxics Integration and the Office of Pesticides and Toxic Substances. U.S. Environmental Protection Agency. July 1982.

120. Kearney, D. C., et al. Tetrachlorodibenzo-p-dioxin in the Environment: Sources, Fate, and Decontamination. Environmental Health Perspectives. Volume 5, 1973. pp. 273-277.

121. Keitz, E. et al. (Mitre Corporation) Hazardous Waste Incineration: A Profile of Existing Facilities, EPA Contract No. 68-03-3021, July 1982.

122. Kemp, Clinton C., Needed: Plain Talk About Dioxin. Waste Age. May 1985 v.15, No. 5 pp. 142-152.

123. Kim, N. Building Reclamation After Dioxin Contamination by PCB Fires: Accidental Exposure to Dioxins: Human Health Aspects. F. Coulston and F. Pocchiari (eds). Academic Press, 1983, pp. 185-186.

124. Kimble, B. J. Comments on "Chlorinated Dibenzo-p-dioxins and Related Compounds in Incinerator Effluents." Chemosphere. Volume 10, 1981. pp. 243-244.

125. Kimble, B. J. and M. L. Gross. Tetrachlorodibenzo-p-dioxin Quantitation in Stack-Collected Coal Fly Ash. Science. Volume 207. January 1980. pp. 59-61.

126. Kimbrough, R. D. ed. Halogenated Biphenyls, Terphenyls, Naphthalenes, Dibenzodioxins, and Related Products. Elsevier/North Holland Biomedical Press, Amsterdam. 1980. 406 pp.

127. Kooke, R., et al. Extraction Efficiencies of Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans from Fly Ash. Analytical Chemistry. Volume 53, 1981. pp. 461-463.

128. Kriebel, D. Dioxins: Toxic and Still Troublesome. Environment. Volume 23, Number 1. January/February 1981. pp. 6-13.

129. Krishnan E. R., and G. V. Hellwig. Trace Emissions from Coal and Oil Combustion. Environmental Progress (Vol. 1, No. 4) November 1982. pp. 290-296.

130. Kulkarni, S. (TRW Inc.) Pollution Aspects of the Thermal Regeneration of Spent Activated Carbon. U. S. Environmental Protection Agency, Research Triangle Park, N.C., February 1984. 39 pp.

131. Lahaniatis, E. S., et al. On the Occurrence of Chlorinated Hydrocarbons in Fly Ash from Waste Combustion Facilities. Chemosphere. Volume 6, 1977. pp. 11-16.

132. Lamberton, J., et al. The Determination of Polychlorodibenzo-p-dioxins in Pentachlorophenol Wood Treatment Solutions. Journal of the American Industrial Hygiene Association. Volume 40, 1979. pp. 816-822.

133. Lamparski, L. L. et al. Photolysis of Pentachlorophenol-Treated Wood. Chlorinated Dibenzo-p-dioxin Formation. Environmental Science and Technology. Volume 14, No. 2. February 1980. pp. 196-200.

134. Lamparski, L. L. and T. J. Nestrick. Determination of Tetra-, Hexa-, Hepta-, and Octachlorodibenzo-p-dioxin Isomers and Particulate Samples at Parts Per Trillion Levels. Analytical Chemistry. Volume 52, 1980. pp. 2045-2059.

135. Lao, R. C. et al. Investigation of PAH and Polychlorinated Organic Pollutant Emissions from Wood Combustion Sources. From: Polynuclear Aromatic Hydrocarbons: Formation, Metabolism and Measurement, 7th International Symposium. Columbus, Ohio, Oct. 26-28, 1982

136. Lee, K. W. et al (Radian Corporation) J. M. Huber PCB Destruction Process Trial Burn Report. (Prepared for J. M. Huber Corp. Borger, Texas,) October 1983.

137. Leinster, C. The Sweet Smell of Profits from Trash. Fortune, Vol. III No. 7, April 1, 1985.

138. Levin, J. O. and C. A. Nilsson. Chromatographic Determination of Polychlorinated Phenols, Phenoxyphenols, Dibenzofurans, and Dibenzodioxins in Wood Dust from Worker Environments. Chemosphere. Volume 6, 1977. pp. 443-498.

139. Levin, J. O., et al. Use of Chlorophenols and Fungicides in Sawmills. Scandinavian Journal of Work Environment and Health. Volume 2, 1976. pp. 71-81.

140. Liberti, A., and D. Brocco. Formation of Polychlorodibenzo-Dioxins and Polychlorodibenzofurans in Urban Incinerators Emissions. In: Chlorinated Dioxins & Related Compounds Impact on the Environment. O. Hutzinger, R. W. Frei, E. Merian, F. Pocchiari (eds.) Pergamon Press 1982, pp. 245-251.

141. Liberti, A., G. Goretti, and M. V. Russo. Formation of Polychlorodibenzodioxins and Polychlorodibenzofurans in Urban Wastes Incineration. Gazzetta Chimica Italiana, 113 No. 9-10, 1983.

142. Liberti, A., et al. Determination of Polychlorinated Dibenzo-p-dioxins and Dibenzofurans in the Emissions from Urban Incinerators. Mikrochimica Acta. Volume I, 1981. pp. 271-280.

143. Liberti, A., et al. Evaluation of Organochlorine Compounds in the Emissions of Urban Incinerators. From the Pergamon Series on Environmental Science Volume 3 - Analytical Techniques in Environmental Chemistry. 1980. pp. 157-166.

144. Liberti, A. and D. Brocco. Formation of Polychlorodibenzo-dioxins and Polychlorodibenzofurans in Urban Incinerators Emissions: Chlorinated Dioxins and Related Compounds Impact on the Environment. O. Hutzinger, R.W. Frei, E. Merian, F. Pocchiari (eds). Pergamon Press, 1982, pp. 245-251.

145. Liberti, A., et al. PCDD and PCDF Formation in the Combustion of Vegetable Wastes. Chemosphere, Volume 12, No. 4/5, 1983, pp. 661-663.

146. Lindahl, R. et al Formation of Polychlorinated Dibenzofurans (PCDFs) and Polychlorinated Dibenzo-p-dioxins (PCDDs) from the Pyrolysis of Polychlorinated Diphenyl Esters. Chemosphere, Vol. 9, pp. 351-361, 1980.

147. Liptak, B.G. Environmental Engineers Handbook, Volume 3, Chilton Book Company, Ontario, Canada, 1974, p. 283.

148. Lustenhouwer, J., et al. Chlorinated Dibenzo-p-dioxins and Related Compounds in Incinerator Effluents: A Review of Measurements and Mechanisms of Formation. Chemosphere. Volume 9, 1980. pp. 501-522.

149. Mahle, N. and L. Whiting (Dow Chemical). The Formation of Chlorodibenzo-p-dioxins by Air Oxidation and Chlorination of Bituminous Coal. Chemosphere. Volume 9, 1980. pp. 693-699.

150. Main, J. Dow vs. The Dioxin Monster. Fortune, Vol. 107 (11), May 30, 1983.

151. Makasani, J. Don't Let the Dioxin Issue Axe New Refuse-Fired Power Plants. Power, August 1984, pp. 87-89.

152. Mamantov, A. Linear Correlation Between Photolysis and Toxicity of Polychlorinated Dibenzo-p-dioxins. Environmental Science Technology, 1984, 18, pp. 808-810.

153. Mantell, C.L. Carbon and Graphite Handbook, Interscience Publishers, New York, 1968.

153a. Memo from Amendola, G. A., Project Manager, Michigan Dioxin Studies,
* Region V to D. G. Barnes, Chairman Coordinator, Dioxins Work Group. Michigan Dioxin Studies--Ambient Air/Dow Chemical Emissions Data. September 5, 1985.

154. Memo from Cook, M.B., Dioxin Management Coordinator, U.S. Environmental Protection Agency, to Schatzow, S. and List of Addressees. February 13, 1984.

155. Memo from Poppiti, J., Manager -Delisting Program, U.S.Environmental Protection Agency, to Chlorinated Dioxins Workgroup and List of Addressees. May 23, 1985. 25 pp. RCRA Dioxin Delisting Petition for the Mobile Incinerator System.

156. Miller, S. E. et al. Determination of Dioxin and Furan Levels in
* Effluent Streams of the Cincinnati Waterworks Carbon Reactivation System. EPA Contract No. 68-01-6702. July 1985.

157. Mix, T. W. and B. L. Murphy. Risks Associated with Waste-Fuel Use in Cement Kilns. Environmental Progress Vol. 3, No. 1, 1984. pp. 64-70.

158. Moore, J. A. Assistant Administrator for Pesticides and Toxic
* Substances. (Memorandum) Advance Notice of Proposed Rulemaking on PCB Electrical Transformer Fires.

159. Morselli, L., et al. Analysis of the Effluents of an Urban-Solid Refuse Incinerator: Study of Methods of Extraction and Analysis for the Quantitative Determination of Polychlorodibenzo-p-dioxins. Annals of the Italian Chemical Society - 1981. Volume 71, Nos. 9-10. pp. 557-572.

160. (MRI). Assessment of Emission of Specific Compounds from a Resource Recovery Municipal Refuse Incinerator. EPA Contract No. 68-01-5915. May 22, 1985. EPA 560/5-84-002.

161. (MRI). Performance Evaluation of Full Scale Hazardous Waste
* Incinerators. Draft Final Report. (Prepared for U.S. Environmental Protection Agency, Incineration Research Division) January 1984.

162. (MRI Report). PDCF Formation from PCB's Under Fire Conditions EPA Contract No.68-02-3938. Sept. 20, 1984.

163. National Research Council of Canada. Polychlorinated Dibenzo-p-Dioxins: Criteria for Their Effects on Man and His Environment. NRCC No. 18574. 1981. 251 pp.

164. National Research Council of Canada. Polychlorinate Dibenzofurans: Criteria for Their Effects on Humans and the Environment. NRCC No. 22846. 1984. 243 pp.

165. Nestrick, T. J. and L. L. Lamparski. Isomer-Specific Determination of Chlorinated Dioxins for Assessment of Formation and Potential Environmental Emission from Wood Combustion. Analytical Chemistry. 54: 2292-2299. 1982.

166. Nestrick, T. J., et al. (Dow Chemical) Comments on Variations in Concentrations of Organic Compounds Including Polychlorinated Dibenzo-p-dioxins and Polynuclear Aromatic Hydrocarbons in Fly Ash from a Municipal Incinerator. Analytical Chemistry. Volume 54, 1982. pp. 823-824.

167. Nestrick, T. J., et al. (Dow Chemical) Methodology and Preliminary Results for the Isomer-Specific Determination of TCDDs and Higher Chlorinated Dibenzo-p-dioxins in Chimney Particulates from Wood-Fueled Domestic Furnaces Located in Eastern Central, and Western Regions of the United States. Presented at the International Symposium on Chlorinated Dioxins and Related Compounds, Arlington, VA, October 25-29, 1981.

168. Neulicht, R. Dioxin Analysis of Philadelphia Northwest and East Central Incinerators: Preliminary Summary of Results. Midwest Research Institute. EPA Contract 68-02-3891 July 1, 1985.

169. New York State/ Department of Environmental Conservation Municipal Refuse Combustion - Recommendations for Standards and Guidelines. February 1985. 22 pp.

170. Niessen, W. R. Production of Polychlorinated Dibenzo-p-Dioxins (PCDD) and Dibenzofurans (PCDF) from Resource Recovery Facilities. Part II. Presented at 1984 National Waste Processing Conference--Engineering: The Solution. Orlando, Fla. June 3-6, 1984.

171. NIOSH. Current Intelligence Bulletin 40. 2,3,7,8-Tetrachlorodibenzo-p-dioxin. January 23, 1984.

172. North County Recycling and Energy Recovery Center. Risk Assessment for Trace Element and Organic Emissions. April 1984.

173. (Northrop Services, Inc.) How to Operate the Hazardous Waste Incinerator. In: Course Notes, Hazardous Waste Incinerator Session, Air Toxics Course 86. November 10, 1983. 54 pp.

174. Nunn, A. B. Evaluation of HCl and Chlorinated Organic Compound Emissions
* from Refuse Fired Waste-to-Energy Systems. (Draft) Prepared for U.S. Environmental Protection Agency, ORD, Research Triangle Park, NC, 1983.

175. O'Connell, W. L. Distribution of Data on the Emission of Dioxins from Incinerators. Presented at Southwestern Ohio Chapter APCA Specialty Meeting on Air Toxics, May 31, 1984.

176. O'Hara P.A., and R. C. Ahlert. Mechanisms of Formation of Polychlorinated Dibenzo-p-dioxins in Municipal Incinerators.

177. Olie, K., et al. Chlorodibenzo-p-dioxins and Chlorodibenzo-furans are Trace Components of Fly Ash and Flue Gas of Some Municipal Incinerators in the Netherlands. Chemosphere. Volume 6, 1977. pp. 455-459.

178. Olie, K., et al. Polychlorinated Dibenzo-p-dioxins and Related Compounds in Incinerator Effluents. From Pergamon Series on Environmental Science Volume 5 - Chlorinated Dioxins and Related Compounds Impact on the Environment. 1982. pp. 227-244.

179. Olie, K., et al. Formation and Fate of PCDD and PCDF from Combustion Processes. Chemosphere, Volume 12, No. 4/5, 1983, pp. 627-636.

180. Olie, K. and O. Hutzinger. Detection of Polychlorodibenzodioxins in Fly Ash and Flue Gas of Municipal Incinerators. Recent Developments in Mass Spectrometry in Biochemistry and Medicine. (Proceedings of the 4th International Symposium.) Alberto Frigerio, ed. Volume 1, 1978. pp. 555-562.

181. Ontario Ministry of the Environment, Air Resources Branch. Report on Combustion Testing Program at the Swaru Plant, Hamilton-Wentworth. (Prepared by Envirocon Limited) January 1984.

182. Ozvacic, V., Wong G., Tosine H., Clement R. E., and J. Osborne Emissions of Chlorinated Organics from Two Municipal Incinerators in Ontario. For Presentation at the 77th Annual Meeting of the Air Pollution Control Association. San Francisco, Calif. June 24-29, 1984.

183. Peters, J. A., T. W. Hughes and R. E. Mournighan. Evaluation of Hazardous Waste Incineration in a Cement Kiln at San Juan Cement. In: Incineration & Treatment of Hazardous Waste - Proceedings of the Ninth Annual Research Symposium. EPA-600/9-84-015, U.S. Environmental Protection Agency, Cincinnati, Ohio July 1984. p. 210-24.

184. Peters, J. A. (Monsanto Research Corp.). Evaluation of Hazardous Waste
* Incineration in Cement Kilns at San Juan Cement Company. (Prepared for Incineration Research Branch, Industrial Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268) Contract No. 68-03-3025, January 1983.

185. Raloff, J. Dioxin: Is Everyone Contaminated? Science News Vol. 128 July 13, 1985. pp. 26-29.

186. Rao, K. R. (editor). Pentachlorophenol: Chemistry, Pharmacology, and Environmental Toxicology, Plenum Press, New York, 1978.

187. Rappe, C. Analysis of Polychlorinated Dioxins and Furans. Environmental Science Technology. Vol. 18, No. 3, 1984 pp. 78-90.

188. Rappe, C. Source & Identification, Especially With Respect to PCDDs and PCDFs Found in Emissions of Incinerators.

189. Rappe, C., et al. Dioxins, Dibenzofurans, and Other Polyhalogenated Aromatics: Production, Use, Formation, and Destruction. Annals of the New York Academy of Sciences. Volume 320. pp. 1-18.

190. Rappe, C., et al. Formation of Polychlorinated Dibenzo-p-dioxins (PCDDs) and Dibenzofurans (PCDF) by Burning or Heating Chlorophenates. Chemosphere. Volume 7, 1978. pp. 269-281.

191. Rappe, C., et al. Occupational Exposure to Polychlorinated Dioxins and Dibenzofurans. From Pergamon Series on Environmental Science Volume 5 - Chlorinated Dioxins and Related Compounds Impact on the Environment. 1982. pp. 495-513.

192. Rappe, C., et al. Polychlorinated Dioxins, Dibenzofurans, and other Polynuclear Aromatics Formed During PCB Fires. Chemica Scripta, Volume 20, 1982, pp. 56-61.

193. Rappe, C. and S. Marklund. Thermal Degradation of Pesticides and Xenobiotics: Formation of Polychlorinated Dioxins and Dibenzofurans. Pesticide Chemistry: Human Welfare and Environment, Proc. Int. Congress Pesticide Chem., 5th, Volume 3, 1983, pp. 317-322.

194. Rappe, C., S. Marklund, P. A. Bergquist, and M. Hansson. Polychlorinated Dibenzo-p-dioxins, Dibenzofurans, and Other Polynuclear Aromatics Formed During Incineration and Polychlorinated Biphenyl Fires. In: Chlorinated Dioxin and Dibenzofurans in the Total Envinronment. Chapter 7. Choudhary, G., Keith, L.H. Rappe, C. (eds) Buttersworth Publishers 1983.

195. Rawls, R. L. Dow Finds Support, Doubt for Dioxin Ideas. Chemical and Engineering News. February 12, 1979. pp. 23-29.

196. Redford, D. P., C. L. Haile and R. M. Lucas. Emissions of PCDDs and PCDFs from Combustion Sources. Presented at The International Symposium on Chlorinated Dioxins and Related Compounds. Arlington, Virginia, October 25-29, 1981.

197. Rghei, H. O. and G. A. Eiceman. Adsorption and Thermal Reactions of 1,2,3,4-Tetrachlorodibenzo-p-dioxin on Fly Ash from a Municipal Incinerator. Chemosphere. Volume 11, No. 6, 1982, pp. 569-576.

198. Rghei, H. O. and G. A. Eiceman. Adsorption and Chlorinateion of Dibenzo-p-Dioxin and 1 Chlorodibenxo-p-Dioxin on Fly Ash from Municipal Incinerators. Chemosphere, Vol. 13, No. 3, pp 421-426, 1984.

199. Rghei, H. O. and G. A. Eiceman. Effect of Matrix on Heterogenous Phase Chlorine Substitution Reactions for Dibenzo-p-dioxin and HCL in Air. Chemosphere Vol. 14, No. 2, pp 167-171, 1985.

200. Sachdev, A. K. and I. J. Marvan. Thermal Destruction of Chlorophenol Residues. Prepared for Environmental Protection Service, Canada. July 1983. 107 pp.

201. Samuelson, U. and A. Lindskog. Chlorinated Compounds in Emissions from Municipal Incineration. Chemosphere, Vol. 12, No. 4/5, pp 665-668, 1983.

202. Sawyer, T., et al. Bioanalysis of Polychlorinated Dibenzofuran and Dibenzo-p-dioxin Mixtures in Fly Ash. Paper Presented at the 3rd International Symposium on Chlorinated Dioxins and Related Compounds. Salzburg, Austria, October 12-14, 1982.

203. Sawyer, T., et al. Bioanalysis of Polychlorinated Dibenzofuran and Dibenzo-p-dioxin Mixtures in Fly Ash. Chemosphere 12: 529-535, 1983.

204. Scharsach, A. Incinerator Emission Control Technology - Present and Future Processes. Ontario Ministry of Energy - Energo '83: Energy Opportunities in Biomass Symposium, Toronto, Mar. 6-9, 1983.

205. (Scott Environmental Services.) Sampling and Analysis of Chlorinated Organic Compound Emissions from the Hampton Waste-to-Energy System. March 1985.

206. Shaub. W. M. Containment of Dioxin Emissions from Refuse Fired Thermal Processing Units - Prospects and Technical Issues. NBSIR 84-2872, U.S. National Bureau of Standards, Washington, D.C. April 1984. 150 pp.

207. Shaub, W. M. Technical Issues Concerned with PCDD and PCDF Formation and Destruction in MSW Fired Incinerators. NBSIR 84-2975, U.S. National Bureau of Standards, Washington, D.C., November 1984. 41 pp.

208. Shaub, W. M. and Wing Isang. Dioxin Formation in Incinerators. Environmental Science and Technology, Vol. 17, p. 721, December 1980.

209. Shen, T. T. Air Quality Impact of Trace Contaminants from Coal Conversion. From: Proceedings of the Governors Conference on Expanding the Use of Coal in New York State: Problems & Issues, May 21-22, 1981 Albany, N.Y.

210. Shih, C., et al. (TRW, Inc.) Emissions of Polychlorinated Dibenzo-p-dioxins (PCDDs) and Dibenzofurans (PCDFs) from the Combustion of Fossil Fuels, Wood, and Coal Refuse. (Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC) EPA Contract No. 68-02-3138. December 1980.

211. Shih, C., et al. (TRW, Inc.) POM Emissions from Stationary Conventional Combustion Processes, with Emphasis on Polychlorinated Compounds of Dibenzo-p-dioxin (PCDDs), Biphenyl (PCBs), and Dibenzofuran (PCDFs). (Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC) EPA Contract No. 68-02-3138. September 1979.

212. Short, H. Dioxin Cleanup Methods Get Worldwide Attention. Chemical Engineering, Nov. 26, 1984.

213. Sigsby, J.E. Dioxins in Mobile Sources Particles. U.S. Environmental * Protection Agency, Mobile Source Measurements Research Section. February 23, 1982.

214. Smith, R. J. Dioxins Have Been Present Since the Advent of Fire, Says Dow. Science. Volume 202. December 1978. pp. 1166-1167.

215. Smith, R. M., *et al*. Analysis for 2,3,7,8-TCDD and 2,3,7,8-TCDF in a Soot Sample from a Transformer Explosion in Binghamton, NY. Chemosphere, Volume 2, No. 8, 1982, pp. 715-720.

216. Stanley, J. S. et al. Quality Assurance Program for Combustion Source Studies. In: Identification and Analysis of Organic Pollutants in Air, L. H. Keith (ed.) Butterworth Publishers 1984. pp. 459-473.

217. State of California Air Resources Board. Air Pollution Control at Resource Recovery Facilities - Final Report. May 24, 1984. 393 pp.

218. State of Washington. Letter from C. Jonathan Neel, District Supervisor * to Ms. Karen Karl. Nov. 28, 1984.

219. Stehl, R. H., and L. L. Lamparski. Combustion of Several 2,4,5-Trichlorophenoxy Compounds: Formation of 2,3,7,8-TCDD. Science. Volume 197. September 1977. pp. 1008-1009.

220. Stretz, L. A., *et al*. Controlled Air Incineration of PCP-Treated Wood. (Prepared for U.S. Environmental Protection Agency, Industrial Environmental Research Laboratory) 1982.

221. (Swiss Federal Office of Environmental Protection) Environmental Pollution Due to Dioxins and Furans from Communal Rubbish Incineration Plants. Schriftenreihe Umweltschutz. No. 5., 1982.

222. Taylor, M. L. *et al*. Assessments of Incineration Processes as Sources of Supertoxic Chlorinated Hydrocarbons: Concentration of Polychlorinated Dibenzo-p-dioxins/Dibenzofurans and Possible Precursor Compounds in Incinerator Effluents. Chapter 8. In: Chlorinated Dioxins and Dibenzofurans in the Total Environment. G. Choudhary, L. H. Keith, and C. Rappe eds. Butterworth Publishers, Ann Arbor Science Book, 1983.

223. (TDI, Inc.) The Dibenzofurans. (Prepared for U.S. Environmental Protection Agency, Washington, D.C.) EPA Contract No. 68-03-2919. 1981.

224. Teller, A. J. and J. D. Lauber. Control of Dioxin Emissions from Incineration. Paper presented at the 76th Annual Meeting and Exhibition of the Air Pollution Control Association, Atlanta, Georgia. June 19-24, 1983.

225. Test Report for Toxic Screening at the Philadelphia Northwest Municipal Incinerator. EPA Contract No. 68-02-3960.

226. Tiernan, M. L. et al. Chlorodibenzodioxins, Chlorodibenzofurans, and Related Compounds in the Effluent from Combustion Processes. Chemosphere, Volume 12, No. 4/5, 1983, pp. 565-606.

227. Tiernan, T. O., Chlorodibenzodioxins and Chlorodibenzofurans: An Overview. In: Detoxification of Hazardous Wastes, Ann Arbor Science. Publishers, 1982. pp. 243-260.

228. Tiernan, T. O., et al. Characterization of Toxic Components in the Effluent from a Refuse-Fired Incinerator. Resources and Conservation. Volume 9, 1982, pp. 343-354.

229. Tong, H. Y. et al. Identification of Orange Compounds Obtained from Incineration of Municipal Waste by High-Performance Liquid Chromatographic Fractionation and Gas Chromatogrpahy-Mass Spectrometry. Journal of Chromatography 285 (1984) 423-441.

230. Townsend, D. E. (Dow Chemical). The Use of Dioxin Isomer Group Ratios to Identify Sources and Define Background Levels of Dioxins in the Environment. Journal of Environmental Science and Health. Volume B15, 1980. pp. 571-609.

231. Townsend, D. I. Change of Isomer Ratio and Fate of Polychlorinated-p-dioxins in the Environment. Chemosphere, Vol. 12, No. 9/5, pp. 637-643, 1983.

232. Tremblay, J. W. The Design, Implementation, and Evaluation of the Industrial Hygiene Program Used During the Disposal of Herbicide Orange. In: Human and Environmental Risks of Chlorinated Dioxins and Related Compounds, 1983. R. E. Tucker, A. L. Young, and A. P. Gray (eds).

233. U. S. Army Environmental Hygiene Agency. Incineration of Pentachlorophenol-Treated Wood, Tooele Army Depot, Tooele, Utah. 19-30 October 1981, and 14-30 June 1982.

234. U. S. Environmental Protection Agency. PCB Disposal by Thermal
* Destruction. NTIS - PB82-241860, U.S. Environmental Protection Agency, Dallas, TX, June 1981.

235. U. S. Environmental Protection Agency. Unpublished EPA Sewage Sludge Task Force Report.

236. (U. S. Conference of Mayors) Resource Recovery Activities. Waste Age, pg. 56, November 1983.

237. U. S. DOE, Report on the 1980 Manufacturing Industries Energy Consumption Study and Survey of Large Combustors, DOE/EIA-0358, January 1983.

238. U. S. Environmental Protection Agency. Application of Combustion Modifications to Industrial Combustion Equipment, EPA-600/7-79-015a, January 1979.

239. U. S. Environmental Protection Agency. Kraft Pulping: Control of TRS Emissions from Existing Mills. EPA-450/2-78-003b, March 1979.

240. Velzy, C.O. ASME's Role in Developing Standards for Measurement of Dioxin Emissions.

241. Versar, Inc. Memorandum. Method for Characterization of Toxic Emissions from the Burning of Waste Oil, from Shiv Krishnan, February 13, 1984.

242. Viau, A.C., S. M. Studak, and F. W. Karasek. Comparative Analysis of Hazardous Compounds on Fly-Ash from Municipal Waste Incineration by Gas Chromatography/ Mass Spectrometry. Canadian Journal of Chemistry, Nov. 1984, 62 (11).

243. Vick, R. D., et al. Organic Emissions from Combustion of Combination Coal Refuse to Produce Electricity. Chemosphere. Volume 7, 1978. pp. 893-902.

244. Villaneuva, E. C., et al. Chlorodibenzo-p-dioxin Contamination of Two Commercially Available Pentachlorophenols. Journal of Agricultural and Food Chemistry. Volume 21, No. 4. July/August 1973. pp. 739-740.

245. Wang, D. K. W. et al. Sampling and Analytical Methodologies for PCDDs and PCDFs in Incinerators and Wood Burning Facilities. In Environmental Science and Research, 1983, Vol. 26 No. Human and Environmental Risks of Chlorinated Dioxins and Related Compounds pp. 113-126.

246. Weston, R. F. Results of the Silvex Test Burn DRE's. Draft Report. * September 9, 1983.

247. Witness Statement from Ozvacic, V. M., Ministry of the Environment, concerning Magnitude of Dioxin and Furan Emissions from the Proposed Energy Waste Plant, Victoria Hospital Corporation. Westminster Campus, London Ontario. January 11, 983. 10 pp.

248. Wong, T.S. Dioxin Formation and Destruction Combustion Processes. For presentation at the 77th Annual Meeting of the Air Pollution Control Association, San Francisco, Calif. June 24-29, 1984.

249. Yakowitz, H. Background Information With Respect to Dioxin Issues Associated With Incineration of Municipal Solid Waste. ENV/WMP/85.11 Organization for Economic Co-Operation and Development, Paris, France. February 22, 1985. 34 pp.

APPENDIX B

LITERATURE DATA BASE

Dioxin Literature Data Base

Key to Abbreviations. B-1

Municipal Solid Waste Combustors. B-2

Fossil Fuel Combustion. B-51

Sewage Sludge Incinerators. B-53

Wood Combustion B-54

Boilers Cofiring Wastes B-61

Hazardous Waste Incinerators. B-67

Lime/Cement Kilns B-79

Hospital Incinerators B-80

Wire Reclamation Incinerator. B-83

PCB Fires B-84

Automobile Emissions. B-88

Thermal Activated Carbon Regeneration B-89

Experimental. B-97

KEY TO ABBREVIATIONS

REF #/ = Reference Number/Sample or Sample Number

dscm = Dry Standard Cubic Meter

ESP = Electrostatic Precipitator

FA = Fly Ash

FG = Flue Gas

g = Gram

GC = Gas Chromatography

GS = Grab Sample

HRGC = High Resolution Gas Chromatography

HRMS = High Resolution Mass Spectrophotometry

M^3 = Cubic Meter

MM5T = Modified Method 5 Train

MS = Mass Spectrophotomer

N/A = Not Available

ND = Not Detected

ng = Nanogram = 10^{-9} grams

NM^3 = Normal Cubic Meter

PART = Particulate Phase Sample

ppb = Parts Per Billion

ppm = Parts Per Million

ppt = Parts Per Trillion

ug = Micrograms = 10^{-6} grams

* = Preliminary Data or Draft Report

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
12/SM 283	OCDD	1 ug/kg	N/A	FA	GS
12/SM 294	OCDD	13 ug/kg	N/A	FA	GS
12/MA-LFU	OCDD	15 ug/kg	N/A	FA	GS
12/LFI-NW	OCDD	800 ug/kg	N/A	FA	GS
12/S-LFU	OCDD	520 ug/kg	N/A	FA	GS
12/SM03,81	OCDD	<0.5 ug/kg	N/A	FA	GS
21/2A/A	2378-TCDD	< 1 ng/nm3	STACK	FG	MM5T
21/2A/A	P5CDD	< 1 ng/nm3	STACK	FG	MM5T
21/2A/A	H6CDD	< 1 ng/nm3	STACK	FG	MM5T
21/2A/A	H7CDD	< 1 ng/nm3	STACK	FG	MM5T
21/2A/A	OCDD	2.3 ng/nm3	STACK	FG	MM5T
21/2A/B	2378-TCDD	< 6 ng/nm3	STACK	FG	MM5T
21/2A/B	P5CDD	< 1 ng/nm3	STACK	FG	MM5T
21/2A/B	H6CDD	< 2 ng/nm3	STACK	FG	MM5T
21/2A/B	H7CDD	< 1 ng/nm3	STACK	FG	MM5T
21/2A/B	OCDD	< 1 ng/nm3	STACK	FG	MM5T
21/2B/A	2378-TCDD	< 1 ng/nm3	STACK	FG	MM5T
21/2B/A	P5CDD	< 1 ng/nm3	STACK	FG	MM5T
21/2B/A	H6CDD	< 2 ng/nm3	STACK	FG	MM5T
21/2B/A	H7CDD	< 2 ng/nm3	STACK	FG	MM5T
21/2B/A	OCDD	< 1 ng/nm3	STACK	FG	MM5T
21/2B/B	2378-TCDD	< 1 ng/nm3	STACK	FG	MM5T
21/2B/B	P5CDD	< 1 ng/nm3	STACK	FG	MM5T
21/2B/B	H6CDD	< 1 ng/nm3	STACK	FG	MM5T
21/2B/B	H7CDD	< 1 ng/nm3	STACK	FG	MM5T
21/2B/B	OCDD	< 2 ng/nm3	STACK	FG	MM5T
25/A	TCDD	10 ng/g	FUME	PART.	N/A
25/A	P5CDD	266 ng/g	FUME	PART.	N/A
25/A	H6CDD	718 ng/g	FUME	PART.	N/A
25/A	H7CDD	1220 ng/g	FUME	PART.	N/A
25/A	OCDD	498 ng/g	FUME	PART.	N/A
25/A	OCDF	468 ng/g	FUME	PART.	N/A
25/A	TCDD	-	-----	FA	GS
25/A	TCDF	-	-----	FA	GS
25/A	P5CDD	-	-----	FA	GS
25/A	P5CDF	-	-----	FA	GS
25/A	H6CDD	24 ppb	-----	FA	GS
25/A	H6CDF	-	-----	FA	GS
25/A	H7CDD	37 ppb	-----	FA	GS
25/A	H7CDF	25 ppb	-----	FA	GS
25/A	OCDD	109 ppb	-----	FA	GS
25/A	OCDF	27 ppb	-----	FA	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
25/B	TCDD	65 ng/g	FUME	PART.	N/A
25/B	P5CDD	291 ng/g	FUME	PART.	N/A
25/B	H6CDD	621 ng/g	FUME	PART.	N/A
25/B	H7CDD	737 ng/g	FUME	PART.	N/A
25/B	OCDD	213 ng/g	FUME	PART.	N/A
25/B	OCDF	68 ng/g	FUME	PART.	N/A
25/B	TCDD	0.6 ppb	-----	FA	GS
25/B	TCDF	3.2 ppb	-----	FA	GS
25/B	P5CDD	3.2 ppb	-----	FA	GS
25/B	P5CDF	21.5 ppb	-----	FA	GS
25/B	H6CDD	18.5 ppb	-----	FA	GS
25/B	H6CDF	34.5 ppb	-----	FA	GS
25/B	H7CDD	41.5 ppb	-----	FA	GS
25/B	H7CDF	50.5 ppb	-----	FA	GS
25/B	OCDD	96 ppb	-----	FA	GS
25/B	OCDF	10.3 ppb	-----	FA	GS
25/C	TCDD	4 ng/g	FUME	PART.	N/A
25/C	P5CDD	114 ng/g	FUME	PART.	N/A
25/C	H6CDD	263 ng/g	FUME	PART.	N/A
25/C	H7CDD	438 ng/g	FUME	PART.	N/A
25/C	OCDD	168 ng/g	FUME	PART.	N/A
25/C	OCDF	138 ng/g	FUME	PART.	N/A
25/C	TCDD	-	-----	FA	GS
25/C	TCDF	-	-----	FA	GS
25/C	P5CDD	-	-----	FA	GS
25/C	P5CDF	-	-----	FA	GS
25/C	H6CDD	-	-----	FA	GS
25/C	H6CDF	-	-----	FA	GS
25/C	H7CDD	-	-----	FA	GS
25/C	H7CDF	-	-----	FA	GS
25/C	OCDD	100 ppb	-----	FA	GS
25/C	OCDF	24 ppb	-----	FA	GS
25	TCDD	85 ng/g	ESP	FA	GS
25	P5CDD	165 ng/g	ESP	FA	GS
25	H6CDD	595 ng/g	ESP	FA	GS
25	H7CDD	835 ng/g	ESP	FA	GS
25	OCDD	520 ng/g	ESP	FA	GS
25	OCDF	125 ng/g	ESP	FA	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
26/A123	H6CDD/F	[illegible] ppb	N/A	FA	GS
26/A123	H7CDD	90.7 ppb	N/A	FA	GS
26/A123	H7CDF	49.3 ppb	N/A	FA	GS
26/A123	OCDD	120 ppb	N/A	FA	GS
26/A123	OCDF	43.6 ppb	N/A	FA	GS
26/B	H6CDD/F	ND	N/A	FA	GS
26/B	H7CDD	6 ppb	N/A	FA	GS
26/B	H7CDF	ND	N/A	FA	GS
26/B	OCDD	12 ppb	N/A	FA	GS
26/B	OCDF	ND	N/A	FA	GS
26/C	H6CDD/F	ND	N/A	FA	GS
26/C	H7CDD	5 ppb	N/A	FA	GS
26/C	H7CDF	ND	N/A	FA	GS
26/C	OCDD	5 ppb	N/A	FA	GS
26/C	OCDF	ND	N/A	FA	GS
32/1	2378-TCDD	0.38 ng/m3	STACK	FG	TRAIN
32/1	T4CDD	17 ng/m3	STACK	FG	TRAIN
32/1	P5CDD	170 ng/m3	STACK	FG	TRAIN
32/1	H6CDD	170 ng/m3	STACK	FG	TRAIN
32/1	H7CDD	140 ng/m3	STACK	FG	TRAIN
32/1	OCDD	17 ng/m3	STACK	FG	TRAIN
32/1	2378-TCDF	2.2 ng/m3	STACK	FG	TRAIN
32/1	T4CDF	41 ng/m3	STACK	FG	TRAIN
32/1	P5CDF	40 ng/m3	STACK	FG	TRAIN
32/1	H6CDF	9.3 ng/m3	STACK	FG	TRAIN
32/1	H7CDF	2.2 ng/m3	STACK	FG	TRAIN
32/1	OCDF	< 2 ng/m3	STACK	FG	TRAIN
32/2	2378-TCDD	0.45 ng/m3	STACK	FG	TRAIN
32/2	T4CDD	14 ng/m3	STACK	FG	TRAIN
32/2	P5CDD	97 ng/m3	STACK	FG	TRAIN
32/2	H6CDD	53 ng/m3	STACK	FG	TRAIN
32/2	H7CDD	71 ng/m3	STACK	FG	TRAIN
32/2	OCDD	< 10 ng/m3	STACK	FG	TRAIN
32/2	2378-TCDF	2.1 ng/m3	STACK	FG	TRAIN
32/2	T4CDF	33 ng/m3	STACK	FG	TRAIN
32/2	P5CDF	21 ng/m3	STACK	FG	TRAIN
32/2	H6CDF	3.9 ng/m3	STACK	FG	TRAIN
32/2	H7CDF	< 1 ng/m3	STACK	FG	TRAIN
32/2	OCDF	< 2 ng/m3	STACK	FG	TRAIN
33	PCDD	0.2 ppm	Stack/ESP	FA	N/A
33	PCDF	0.1 ppm	Stack/ESP	FA	N/A

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
43/#1	T4CDD	19.6 ng/Nm3	Stack	FG	Train
43/#1	P5CDD	27.9 ng/Nm3	Stack	FG	Train
43/#1	H6CDD	178.2 ng/Nm3	Stack	FG	Train
43/#1	H7CDD	159.6 ng/Nm3	Stack	FG	Train
43/#1	O8CDD	63.9 ng/Nm3	Stack	FG	Train
43/#1	T4CDF	ND	Stack	FG	Train
43/#1	O8CDF	59.3 ng/Nm3	Stack	FG	Train
43/#1	T4CDD	1.1 ng/Nm3	Stack	FA	Train
43/#1	P5CDD	2.7 ng/Nm3	Stack	FA	Train
43/#1	H6CDD	11.5 ng/Nm3	Stack	FA	Train
43/#1	H7CDD	1.03 ng/Nm3	Stack	FA	Train
43/#1	O8CDD	8 ng/Nm3	Stack	FA	Train
43/#1	T4CDF	ND	Stack	FA	Train
43/#1	O8CDF	2.2 ng/Nm3	Stack	FA	Train
43/#2	TCDD	0.25 ppb	Dust Col.	FA	GS
43/#2	P5CDD	1.7 ppb	Dust Col.	FA	GS
43/#2	H6CDD	294 ppb	Dust Col.	FA	GS
43/#2	H7CDD	8.9 ppb	Dust Col.	FA	GS
43/#2	OCDD	295 ppb	Dust Col.	FA	GS
43/#2	TCDF	0.46 ppb	Dust Col.	FA	GS
43/#2	OCDF	15.8 ppb	Dust Col.	FA	GS
43/#2	TCDD	172.2 ng/Nm3	Stack	FA	Train
43/#2	P5CDD	172.3 ng/Nm3	Stack	FA	Train
43/#2	H6CDD	12015 ng/Nm3	Stack	FA	Train
43/#2	H7CDD	575 ng/Nm3	Stack	FA	Train
43/#2	OCDD	7312 ng/Nm3	Stack	FA	Train
43/#2	TCDF	75 ng/Nm3	Stack	FA	Train
43/#2	OCDF	2883 ng/Nm3	Stack	FA	Train
43/#2	TCDD	17 ng/Nm3	Stack	FG	Train
43/#2	P5CDD	107 ng/Nm3	Stack	FG	Train
43/#2	H6CDD	26620 ng/Nm3	Stack	FG	Train
43/#2	H7CDD	828 ng/Nm3	Stack	FG	Train
43/#2	OCDD	1179 ng/Nm3	Stack	FG	Train
43/#2	TCDF	108.6 ng/Nm3	Stack	FG	Train
43/#2	OCDF	4390 ng/Nm3	Stack	FG	Train
43/#3	TCDD	ND	Dust Col.	FA	GS
43/#3	P5CDD	0.92 ppb	Dust Col.	FA	GS
43/#3	H6CDD	1.8 ppb	Dust Col.	FA	GS
43/#3	H7CDD	3.1 ppb	Dust Col.	FA	GS
43/#3	OCDD	1.5 ppb	Dust Col.	FA	GS
43/#3	TCDF	0.8 ppb	Dust Col.	FA	GS
43/#3	OCDF	3.3 ppb	Dust Col.	FA	GS
43/#3	TCDD	0.037 ng/Nm3	Stack	FA	Train
43/#3	P5CDD	0.3 ng/Nm3	Stack	FA	Train

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
43/#3	H6CDD	6.7 ng/Nm3	Stack	FA	Train
43/#3	H7CDD	0.2 ng/Nm3	Stack	FA	Train
43/#3	OCDD	1.7 ng/Nm3	Stack	FA	Train
43/#3	TCDF	2.57 ng/Nm3	Stack	FA	Train
43/#3	OCDF	0.08 ng/Nm3	Stack	FA	Train
43/#3	TCDD	19 ng/Nm3	Stack	FG	Train
43/#3	P5CDD	40 ng/Nm3	Stack	FG	Train
43/#3	H6CDD	6542 ng/Nm3	Stack	FG	Train
43/#3	H7CDD	124 ng/Nm3	Stack	FG	Train
43/#3	OCDD	776 ng/Nm3	Stack	FG	Train
43/#3	TCDF	429 ng/Nm3	Stack	FG	Train
43/#3	OCDF	1010 ng/Nm3	Stack	FG	Train
43/#4	TCDD	46.4 ppb	Dust Col.	FA	GS
43/#4	P5CDD	65.4 ppb	Dust Col.	FA	GS
43/#4	H6CDD	2496 ppb	Dust Col.	FA	GS
43/#4	H7CDD	87.9 ppb	Dust Col.	FA	GS
43/#4	OCDD	841.5 ppb	Dust Col.	FA	GS
43/#4	TCDF	61.7 ppb	Dust Col.	FA	GS
43/#4	OCDF	255 ppb	Dust Col.	FA	GS
43/#4	TCDD	10.9 ng/Nm3	Stack	FA	Train
43/#4	P5CDD	2.8 ng/Nm3	Stack	FA	Train
43/#4	H6CDD	0.54 ng/Nm3	Stack	FA	Train
43/#4	H7CDD	3.2 ng/Nm3	Stack	FA	Train
43/#4	OCDD	39 ng/Nm3	Stack	FA	Train
43/#4	TCDF	3.7 ng/Nm3	Stack	FA	Train
43/#4	OCDF	0.06 ng/Nm3	Stack	FA	Train
43/#4	TCDD	60 ng/Nm3	Stack	FG	Train
43/#4	P5CDD	33 ng/Nm3	Stack	FG	Train
43/#4	H6CDD	1390 ng/Nm3	Stack	FG	Train
43/#4	H7CDD	167 ng/Nm3	Stack	FG	Train
43/#4	OCDD	2763 ng/Nm3	Stack	FG	Train
43/#4	TCDF	1814 ng/Nm3	Stack	FG	Train
43/#4	OCDF	1760 ng/Nm3	Stack	FG	Train
43/#5	TCDD	0.7 ppb	Dust. Col.	FA	GS
43/#5	P5CDD	0.05 ppb	Dust. Col.	FA	GS
43/#5	H6CDD	0.021 ppb	Dust. Col.	FA	GS
43/#5	H7CDD	0.007 ppb	Dust. Col.	FA	GS
43/#5	OCDD	0.1 ppb	Dust. Col.	FA	GS
43/#5	TCDF	1.18 ppb	Dust. Col.	FA	GS
43/#5	OCDF	0.0015 ppb	Dust. Col.	FA	GS
43/#5	TCDD	0.34 ng/Nm3	Stack	FA	Train
43/#5	P5CDD	2.4 ng/Nm3	Stack	FA	Train
43/#5	H6CDD	196 ng/Nm3	Stack	FA	Train
43/#5	H7CDD	9.9 ng/Nm3	Stack	FA	Train
43/#5	OCDD	173 ng/Nm3	Stack	FA	Train
43/#5	TCDF	75.3 ng/Nm3	Stack	FA	Train

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
43/#5	OCDF	3.2 ng/Nm3	Stack	FA	Train
43/#5	TCDD	9.6 ng/Nm3	Stack	FG	Train
43/#5	P5CDD	21 ng/Nm3	Stack	FG	Train
43/#5	H6CDD	328 ng/Nm3	Stack	FG	Train
43/#5	H7CDD	46 ng/Nm3	Stack	FG	Train
43/#5	OCDD	244 ng/Nm3	Stack	FG	Train
43/#5	TCDF	305 ng/Nm3	Stack	FG	Train
43/#5	OCDF	89 ng/Nm3	Stack	FG	Train
43/#6	TCDD	ND	Dust Col.	FA	GS
43/#6	P5CDD	ND	Dust Col.	FA	GS
43/#6	H6CDD	ND	Dust Col.	FA	GS
43/#6	H7CDD	0.0012 ppb	Dust Col.	FA	GS
43/#6	OCDD	5.86 ppb	Dust Col.	FA	GS
43/#6	TCDF	ND	Dust Col.	FA	GS
43/#6	OCDF	1.93 ppb	Dust Col.	FA	GS
43/#6	TCDD	ND	Stack	FA	Train
43/#6	P5CDD	0.01 ng/Nm3	Stack	FA	Train
43/#6	H6CDD	0.28 ng/Nm3	Stack	FA	Train
43/#6	H7CDD	ND	Stack	FA	Train
43/#6	OCDD	0.51 ng/Nm3	Stack	FA	Train
43/#6	TCDF	ND	Stack	FA	Train
43/#6	OCDF	ND	Stack	FA	Train
43/#6	TCDD	19 ng/Nm3	Stack	FG	Train
43/#6	P5CDD	11 ng/Nm3	Stack	FG	Train
43/#6	H6CDD	480 ng/Nm3	Stack	FG	Train
43/#6	H7CDD	6 ng/Nm3	Stack	FG	Train
43/#6	OCDD	71 ng/Nm3	Stack	FG	Train
43/#6	TCDF	27 ng/Nm3	Stack	FG	Train
43/#6	OCDF	24 ng/Nm3	Stack	FG	Train
44/A	TCDD	10 ppb	STACK	FG	N/A
44/A	P5CDD	269 ppb	STACK	FG	N/A
44/A	H6CDD	390 ppb	STACK	FG	N/A
44/A	H7CDD	11 ppb	STACK	FG	N/A
44/A	OCDD	8 ppb	STACK	FG	N/A
44/A	TCDF	46 ppb	STACK	FG	N/A
44/A	P5CDF	153 ppb	STACK	FG	N/A
44/A	H6CDF	1712 ppb	STACK	FG	N/A
44/A	H7CDF	47 ppb	STACK	FG	N/A
44/A	OCDF	-----	STACK	FG	N/A
44/A	TCDD	-----	STACK	FG	N/A
44/A	P5CDD	-----	STACK	FG	N/A
44/A	H6CDD	-----	STACK	FG	N/A
44/A	H7CDD	-----	STACK	FG	N/A
44/A	OCDD	-----	STACK	FG	N/A

UNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
44/A	TCDF	8 ppb	STACK	FG	N/A
44/A	P5CDF	4 ppb	STACK	FG	N/A
44/A	H6CDF	-----	STACK	FG	N/A
44/A	H7CDF	-----	STACK	FG	N/A
44/A	OCDF	-----	STACK	FG	N/A
44/A	TCDD	-----	STACK	FG	N/A
44/A	P5CDD	-----	STACK	FG	N/A
44/A	H6CDD	-----	STACK	FG	N/A
44/A	H7CDD	-----	STACK	FG	N/A
44/A	CCDD	-----	STACK	FG	N/A
44/A	TCDF	-----	STACK	FG	N/A
44/A	P5CDF	11 ppb	STACK	FG	N/A
44/A	H6CDF	-----	STACK	FG	N/A
44/A	H7CDF	-----	STACK	FG	N/A
44/A	OCDF	-----	STACK	FG	N/A
44/B	TCDD	-----	STACK	FG	N/A
44/B	P5CDD	168 ppb	STACK	FG	N/A
44/B	H6CDD	173 ppb	STACK	FG	N/A
44/B	H7CDD	127 ppb	STACK	FG	N/A
44/B	OCDD	1 ppb	STACK	FG	N/A
44/B	TCDF	279 ppb	STACK	FG	N/A
44/B	P5CDF	265 ppb	STACK	FG	N/A
44/B	H6CDF	392 ppb	STACK	FG	N/A
44/B	H7CDF	104 ppb	STACK	FG	N/A
44/B	OCDF	-----	STACK	FG	N/A
44/B	TCDD	-----	STACK	FG	N/A
44/B	P5CDD	-----	STACK	FG	N/A
44/B	H6CDD	-----	STACK	FG	N/A
44/B	H7CDD	-----	STACK	FG	N/A
44/B	OCDD	-----	STACK	FG	N/A
44/B	TCDF	5 ppb	STACK	FG	N/A
44/B	P5CDF	5 ppb	STACK	FG	N/A
44/B	H6CDF	-----	STACK	FG	N/A
44/B	H7CDF	-----	STACK	FG	N/A
44/B	OCDF	-----	STACK	FG	N/A
44/B	TCDD	-----	STACK	FG	N/A
44/B	P5CDD	-----	STACK	FG	N/A
44/B	H6CDD	-----	STACK	FG	N/A
44/B	H7CDD	-----	STACK	FG	N/A
44/B	OCDD	-----	STACK	FG	N/A
44/B	TCDF	-----	STACK	FG	N/A
44/B	P5CDF	-----	STACK	FG	N/A
44/B	H6CDF	-----	STACK	FG	N/A
44/B	H7CDF	-----	STACK	FG	N/A
44/B	OCDF	-----	STACK	FG	N/A

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
47/037	TCDD	20 ng/g	STACK	FA	GS
47/037	P5CDD	22 ng/g	STACK	FA	GS
47/037	H6CDD	13 ng/g	STACK	FA	GS
47/037	H7CDD	3 ng/g	STACK	FA	GS
47/037	OCDD	4 ng/g	STACK	FA	GS
47/038	TCDD	20 ng/g	STACK	FA	GS
47/038	P5CDD	23 ng/g	STACK	FA	GS
47/038	H6CDD	16 ng/g	STACK	FA	GS
47/038	H7CDD	5 ng/g	STACK	FA	GS
47/038	OCDD	5 ng/g	STACK	FA	GS
47/039	TCDD	27 ng/g	STACK	FA	GS
47/039	P5CDD	30 ng/g	STACK	FA	GS
47/039	H6CDD	19 ng/g	STACK	FA	GS
47/039	H7CDD	5 ng/g	STACK	FA	GS
47/039	OCDD	5 ng/g	STACK	FA	GS
47/040	TCDD	68 ng/g	STACK	FA	GS
47/040	P5CDD	73 ng/g	STACK	FA	GS
47/040	H6CDD	46 ng/g	STACK	FA	GS
47/040	H7CDD	12 ng/g	STACK	FA	GS
47/040	OCDD	18 ng/g	STACK	FA	GS
47/041	TCDD	18 ng/g	STACK	FA	GS
47/041	P5CDD	19 ng/g	STACK	FA	GS
47/041	H6CDD	13 ng/g	STACK	FA	GS
47/041	H7CDD	4 ng/g	STACK	FA	GS
47/041	OCDD	3 ng/g	STACK	FA	GS
47/042	TCDD	15 ng/g	STACK	FA	GS
47/042	P5CDD	17 ng/g	STACK	FA	GS
47/042	H6CDD	15 ng/g	STACK	FA	GS
47/042	H7CDD	6 ng/g	STACK	FA	GS
47/042	OCDD	20 ng/g	STACK	FA	GS
47/043	TCDD	15 ng/g	STACK	FA	GS
47/043	P5CDD	17 ng/g	STACK	FA	GS
47/043	H6CDD	15 ng/g	STACK	FA	GS
47/043	H7CDD	7 ng/g	STACK	FA	GS
47/043	OCDD	14 ng/g	STACK	FA	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
47/044	TCDD	18 ng/g	STACK	FA	GS
47/044	P5CDD	21 ng/g	STACK	FA	GS
47/044	H6CDD	19 ng/g	STACK	FA	GS
47/044	H7CDD	8 ng/g	STACK	FA	GS
47/044	OCDD	18 ng/g	STACK	FA	GS
47/045	TCDD	17 ng/g	STACK	FA	GS
47/045	P5CDD	22 ng/g	STACK	FA	GS
47/045	H6CDD	18 ng/g	STACK	FA	GS
47/045	H7CDD	8 ng/g	STACK	FA	GS
47/045	OCDD	21 ng/g	STACK	FA	GS
47/046	TCDD	28 ng/g	STACK	FA	GS
47/046	P5CDD	34 ng/g	STACK	FA	GS
47/046	H6CDD	32 ng/g	STACK	FA	GS
47/046	H7CDD	7 ng/g	STACK	FA	GS
47/046	OCDD	8 ng/g	STACK	FA	GS
47/047	TCDD	21 ng/g	STACK	FA	GS
47/047	P5CDD	25 ng/g	STACK	FA	GS
47/047	H6CDD	17 ng/g	STACK	FA	GS
47/047	H7CDD	5 ng/g	STACK	FA	GS
47/047	OCDD	3 ng/g	STACK	FA	GS
47/048	TCDD	31 ng/g	STACK	FA	GS
47/048	P5CDD	33 ng/g	STACK	FA	GS
47/048	H6CDD	17 ng/g	STACK	FA	GS
47/048	H7CDD	4 ng/g	STACK	FA	GS
47/048	OCDD	2 ng/g	STACK	FA	GS
47/049	TCDD	25 ng/g	STACK	FA	GS
47/049	P5CDD	28 ng/g	STACK	FA	GS
47/049	H6CDD	22 ng/g	STACK	FA	GS
47/049	H7CDD	13 ng/g	STACK	FA	GS
47/049	OCDD	31 ng/g	STACK	FA	GS
47/050	TCDD	35 ng/g	STACK	FA	GS
47/050	P5CDD	30 ng/g	STACK	FA	GS
47/050	H6CDD	24 ng/g	STACK	FA	GS
47/050	H7CDD	11 ng/g	STACK	FA	GS
47/050	OCDD	27 ng/g	STACK	FA	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT2	H6CDF	0 ng/g	-----	GARBAGE	GS
49/PT2	H7CDF	0 ng/g	-----	GARBAGE	GS
49/PT2	OCDF	0 ng/g	-----	GARBAGE	GS
49/PT3	TCDD	0 ng/g	-----	GARBAGE	GS
49/PT3	P5CDD	0 ng/g	-----	GARBAGE	GS
49/PT3	H6CDD	0 ng/g	-----	GARBAGE	GS
49/PT3	H7CDD	0 ng/g	-----	GARBAGE	GS
49/PT3	OCDD	1.8 ng/g	-----	GARBAGE	GS
49/PT3	TCDF	0 ng/g	-----	GARBAGE	GS
49/PT3	P5CDF	0 ng/g	-----	GARBAGE	GS
49/PT3	H6CDF	0 ng/g	-----	GARBAGE	GS
49/PT3	H7CDF	0 ng/g	-----	GARBAGE	GS
49/PT3	OCDF	0.3 ng/g	-----	GARBAGE	GS
49/PT4	TCDD	0 ng/g	-----	GARBAGE	GS
49/PT4	P5CDD	0 ng/g	-----	GARBAGE	GS
49/PT4	H6CDD	0.5 ng/g	-----	GARBAGE	GS
49/PT4	H7CDD	3.7 ng/g	-----	GARBAGE	GS
49/PT4	OCDD	15.9 ng/g	-----	GARBAGE	GS
49/PT4	TCDF	0 ng/g	-----	GARBAGE	GS
49/PT4	P5CDF	0 ng/g	-----	GARBAGE	GS
49/PT4	H6CDF	0 ng/g	-----	GARBAGE	GS
49/PT4	H7CDF	0 ng/g	-----	GARBAGE	GS
49/PT4	OCDF	0.2 ng/g	-----	GARBAGE	GS
49/PT2	TCDD	0 ng/g	INCIN.	ASH	GS
49/PT2	P5CDD	0 ng/g	INCIN.	ASH	GS
49/PT2	H6CDD	0 ng/g	INCIN.	ASH	GS
49/PT2	H7CDD	0 ng/g	INCIN.	ASH	GS
49/PT2	OCDD	0 ng/g	INCIN.	ASH	GS
49/PT2	TCDF	0 ng/g	INCIN.	ASH	GS
49/PT2	P5CDF	0 ng/g	INCIN.	ASH	GS
49/PT2	H6CDF	0 ng/g	INCIN.	ASH	GS
49/PT2	H7CDF	0 ng/g	INCIN.	ASH	GS
49/PT2	OCDF	0 ng/g	INCIN.	ASH	GS
49/PT3	TCDD	0 ng/g	INCIN.	ASH	GS
49/PT3	P5CDD	0 ng/g	INCIN.	ASH	GS
49/PT3	H6CDD	0 ng/g	INCIN.	ASH	GS
49/PT3	H7CDD	0 ng/g	INCIN.	ASH	GS
49/PT3	OCDD	0 ng/g	INCIN.	ASH	GS
49/PT3	TCDF	0 ng/g	INCIN.	ASH	GS
49/PT3	P5CDF	0 ng/g	INCIN.	ASH	GS
49/PT3	H6CDF	0 ng/g	INCIN.	ASH	GS
49/PT3	H7CDF	0 ng/g	INCIN.	ASH	GS
49/PT3	OCDF	0 ng/g	INCIN.	ASH	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT4	TCDD	0 ng/g	INCIN.	ASH	GS
49/PT4	P5CDD	0 ng/g	INCIN.	ASH	GS
49/PT4	H6CDD	0 ng/g	INCIN.	ASH	GS
49/PT4	H7CDD	0 ng/g	INCIN.	ASH	GS
49/PT4	OCDD	0 ng/g	INCIN.	ASH	GS
49/PT4	TCDF	0 ng/g	INCIN.	ASH	GS
49/PT4	P5CDF	0 ng/g	INCIN.	ASH	GS
49/PT4	H6CDF	0 ng/g	INCIN.	ASH	GS
49/PT4	H7CDF	0 ng/g	INCIN.	ASH	GS
49/PT4	OCDF	0 ng/g	INCIN.	ASH	GS
49/PT2	TCDD	25 ng/g	BOILER	ASH	GS
49/PT2	P5CDD	11 ng/g	BOILER	ASH	GS
49/PT2	H6CDD	8 ng/g	BOILER	ASH	GS
49/PT2	H7CDD	6 ng/g	BOILER	ASH	GS
49/PT2	OCDD	15 ng/g	BOILER	ASH	GS
49/PT2	TCDF	4 ng/g	BOILER	ASH	GS
49/PT2	P5CDF	4 ng/g	BOILER	ASH	GS
49/PT2	H6CDF	5 ng/g	BOILER	ASH	GS
49/PT2	H7CDF	4 ng/g	BOILER	ASH	GS
49/PT2	OCDF	1 ng/g	BOILER	ASH	GS
49/PT3	TCDD	32 ng/g	BOILER	ASH	GS
49/PT3	P5CDD	13 ng/g	BOILER	ASH	GS
49/PT3	H6CDD	11 ng/g	BOILER	ASH	GS
49/PT3	H7CDD	6 ng/g	BOILER	ASH	GS
49/PT3	OCDD	10 ng/g	BOILER	ASH	GS
49/PT3	TCDF	3 ng/g	BOILER	ASH	GS
49/PT3	P5CDF	4 ng/g	BOILER	ASH	GS
49/PT3	H6CDF	3 ng/g	BOILER	ASH	GS
49/PT3	H7CDF	3 ng/g	BOILER	ASH	GS
49/PT3	OCDF	1 ng/g	BOILER	ASH	GS
49/PT4	TCDD	57 ng/g	BOILER	ASH	GS
49/PT4	P5CDD	16 ng/g	BOILER	ASH	GS
49/PT4	H6CDD	11 ng/g	BOILER	ASH	GS
49/PT4	H7CDD	5 ng/g	BOILER	ASH	GS
49/PT4	OCDD	8 ng/g	BOILER	ASH	GS
49/PT4	TCDF	2 ng/g	BOILER	ASH	GS
49/PT4	P5CDF	2 ng/g	BOILER	ASH	GS
49/PT4	H6CDF	2 ng/g	BOILER	ASH	GS
49/PT4	H7CDF	2 ng/g	BOILER	ASH	GS
49/PT4	OCDF	1 ng/g	BOILER	ASH	GS
49/PT2	TCDD	0 ng/g	ECONOM.	ASH	GS
49/PT2	P5CDD	1 ng/g	ECONOM.	ASH	GS
49/PT2	H6CDD	4 ng/g	ECONOM.	ASH	GS
49/PT2	H7CDD	7 ng/g	ECONOM.	ASH	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT2	OCDD	11 ng/g	ECONOM.	ASH	GS
49/PT2	TCDF	1 ng/g	ECONOM.	ASH	GS
49/PT2	P5CDF	2 ng/g	ECONOM.	ASH	GS
49/PT2	H6CDF	3 ng/g	ECONOM.	ASH	GS
49/PT2	H7CDF	3 ng/g	ECONOM.	ASH	GS
49/PT2	OCDF	1 ng/g	ECONOM.	ASH	GS
49/PT3	TCDD	4 ng/g	ECONOM.	ASH	GS
49/PT3	P5CDD	7 ng/g	ECONOM.	ASH	GS
49/PT3	H6CDD	17 ng/g	ECONOM.	ASH	GS
49/PT3	H7CDD	13 ng/g	ECONOM.	ASH	GS
49/PT3	OCDD	15 ng/g	ECONOM.	ASH	GS
49/PT3	TCDF	3 ng/g	ECONOM.	ASH	GS
49/PT3	P5CDF	3 ng/g	ECONOM.	ASH	GS
49/PT3	H6CDF	4 ng/g	ECONOM.	ASH	GS
49/PT3	H7CDF	1 ng/g	ECONOM.	ASH	GS
49/PT3	OCDF	0 ng/g	ECONOM.	ASH	GS
49/PT4	TCDD	0 ng/g	ECONOM.	ASH	GS
49/PT4	P5CDD	1 ng/g	ECONOM.	ASH	GS
49/PT4	H6CDD	2 ng/g	ECONOM.	ASH	GS
49/PT4	H7CDD	4 ng/g	ECONOM.	ASH	GS
49/PT4	OCDD	7 ng/g	ECONOM.	ASH	GS
49/PT4	TCDF	0 ng/g	ECONOM.	ASH	GS
49/PT4	P5CDF	5 ng/g	ECONOM.	ASH	GS
49/PT4	H6CDF	1 ng/g	ECONOM.	ASH	GS
49/PT4	H7CDF	9 ng/g	ECONOM.	ASH	GS
49/PT4	OCDF	1 ng/g	ECONOM.	ASH	GS
49/PT5	TCDD	7 ng/m3	STACK	FG	MM5T
49/PT5	P5CDD	14 ng/m3	STACK	FG	MM5T
49/PT5	H6CDD	14 ng/m3	STACK	FG	MM5T
49/PT5	H7CDD	18 ng/m3	STACK	FG	MM5T
49/PT5	OCDD	35 ng/m3	STACK	FG	MM5T
49/PT5	TCDF	13 ng/m3	STACK	FG	MM5T
49/PT5	P5CDF	19 ng/m3	STACK	FG	MM5T
49/PT5	H6CDF	24 ng/m3	STACK	FG	MM5T
49/PT5	H7CDF	19 ng/m3	STACK	FG	MM5T
49/PT5	OCDF	5 ng/m3	STACK	FG	MM5T
49/PT6	TCDD	5 ng/m3	STACK	FG	MM5T
49/PT6	P5CDD	19 ng/m3	STACK	FG	MM5T
49/PT6	H6CDD	30 ng/m3	STACK	FG	MM5T
49/PT6	H7CDD	21 ng/m3	STACK	FG	MM5T
49/PT6	OCDD	27 ng/m3	STACK	FG	MM5T
49/PT6	TCDF	40 ng/m3	STACK	FG	MM5T
49/PT6	P5CDF	72 ng/m3	STACK	FG	MM5T
49/PT6	H6CDF	65 ng/m3	STACK	FG	MM5T

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT6	H7CDF	24 ng/m3	STACK	FG	MM5T
49/PT6	OCDF	4 ng/m3	STACK	FG	MM5T
49/PT7	TCDD	3 ng/m3	STACK	FG	MM5T
49/PT7	P5CDD	11 ng/m3	STACK	FG	MM5T
49/PT7	H6CDD	22 ng/m3	STACK	FG	MM5T
49/PT7	H7CDD	43 ng/m3	STACK	FG	MM5T
49/PT7	OCDD	51 ng/m3	STACK	FG	MM5T
49/PT7	TCDF	20 ng/m3	STACK	FG	MM5T
49/PT7	P5CDF	39 ng/m3	STACK	FG	MM5T
49/PT7	H6CDF	57 ng/m3	STACK	FG	MM5T
49/PT7	H7CDF	58 ng/m3	STACK	FG	MM5T
49/PT7	OCDF	9 ng/m3	STACK	FG	MM5T
49/PT5	TCDD	0 ng/m3	BOILER	FG	MM5T
49/PT5	P5CDD	0 ng/m3	BOILER	FG	MM5T
49/PT5	H6CDD	0 ng/m3	BOILER	FG	MM5T
49/PT5	H7CDD	0 ng/m3	BOILER	FG	MM5T
49/PT5	OCDD	0 ng/m3	BOILER	FG	MM5T
49/PT5	TCDF	0 ng/m3	BOILER	FG	MM5T
49/PT5	P5CDF	0 ng/m3	BOILER	FG	MM5T
49/PT5	H6CDF	0 ng/m3	BOILER	FG	MM5T
49/PT5	H7CDF	0 ng/m3	BOILER	FG	MM5T
49/PT5	OCDF	17 ng/m3	BOILER	FG	MM5T
49/PT6	TCDD	0 ng/m3	BOILER	FG	MM5T
49/PT6	P5CDD	0 ng/m3	BOILER	FG	MM5T
49/PT6	H6CDD	0 ng/m3	BOILER	FG	MM5T
49/PT6	H7CDD	0 ng/m3	BOILER	FG	MM5T
49/PT6	OCDD	0 ng/m3	BOILER	FG	MM5T
49/PT6	TCDF	0 ng/m3	BOILER	FG	MM5T
49/PT6	P5CDF	0 ng/m3	BOILER	FG	MM5T
49/PT6	H6CDF	0 ng/m3	BOILER	FG	MM5T
49/PT6	H7CDF	0 ng/m3	BOILER	FG	MM5T
49/PT6	OCDF	14 ng/m3	BOILER	FG	MM5T
49/PT7	TCDD	0 ng/m3	BOILER	FG	MM5T
49/PT7	P5CDD	0 ng/m3	BOILER	FG	MM5T
49/PT7	H6CDD	0 ng/m3	BOILER	FG	MM5T
49/PT7	H7CDD	0 ng/m3	BOILER	FG	MM5T
49/PT7	OCDD	0 ng/m3	BOILER	FG	MM5T
49/PT7	TCDF	0 ng/m3	BOILER	FG	MM5T
49/PT7	P5CDF	0 ng/m3	BOILER	FG	MM5T
49/PT7	H6CDF	0 ng/m3	BOILER	FG	MM5T
49/PT7	H7CDF	0 ng/m3	BOILER	FG	MM5T
49/PT7	OCDF	13 ng/m3	BOILER	FG	MM5T
49/PT5	TCDD	0 ng/g	-----	GARBAGE	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT5	P5CDD	0 ng/g	-----	GARBAGE	GS
49/PT5	H6CDD	0 ng/g	-----	GARBAGE	GS
49/PT5	H7CDD	0 ng/g	-----	GARBAGE	GS
49/PT5	OCDD	3.6 ng/g	-----	GARBAGE	GS
49/PT5	TCDF	0 ng/g	-----	GARBAGE	GS
49/PT5	P5CDF	0 ng/g	-----	GARBAGE	GS
49/PT5	H6CDF	0 ng/g	-----	GARBAGE	GS
49/PT5	H7CDF	0 ng/g	-----	GARBAGE	GS
49/PT5	OCDF	0 ng/g	-----	GARBAGE	GS
49/PT6	TCDD	0 ng/g	-----	GARBAGE	GS
49/PT6	P5CDD	0 ng/g	-----	GARBAGE	GS
49/PT6	H6CDD	0 ng/g	-----	GARBAGE	GS
49/PT6	H7CDD	1.4 ng/g	-----	GARBAGE	GS
49/PT6	OCDD	5.1 ng/g	-----	GARBAGE	GS
49/PT6	TCDF	0 ng/g	-----	GARBAGE	GS
49/PT6	P5CDF	0 ng/g	-----	GARBAGE	GS
49/PT6	H6CDF	0 ng/g	-----	GARBAGE	GS
49/PT6	H7CDF	0 ng/g	-----	GARBAGE	GS
49/PT6	OCDF	0 ng/g	-----	GARBAGE	GS
49/PT7	TCDD	0 ng/g	-----	GARBAGE	GS
49/PT7	P5CDD	0 ng/g	-----	GARBAGE	GS
49/PT7	H6CDD	0 ng/g	-----	GARBAGE	GS
49/PT7	H7CDD	0 ng/g	-----	GARBAGE	GS
49/PT7	OCDD	1.3 ng/g	-----	GARBAGE	GS
49/PT7	TCDF	0 ng/g	-----	GARBAGE	GS
49/PT7	P5CDF	0 ng/g	-----	GARBAGE	GS
49/PT7	H6CDF	0 ng/g	-----	GARBAGE	GS
49/PT7	H7CDF	0 ng/g	-----	GARBAGE	GS
49/PT7	OCDF	0 ng/g	-----	GARBAGE	GS
49/PT5	TCDD	0 ng/g	INCIN.	ASH	GS
49/PT5	P5CDD	0 ng/g	INCIN.	ASH	GS
49/PT5	H6CDD	0 ng/g	INCIN.	ASH	GS
49/PT5	H7CDD	0 ng/g	INCIN.	ASH	GS
49/PT5	OCDD	0 ng/g	INCIN.	ASH	GS
49/PT5	TCDF	0 ng/g	INCIN.	ASH	GS
49/PT5	P5CDF	0 ng/g	INCIN.	ASH	GS
49/PT5	H6CDF	0 ng/g	INCIN.	ASH	GS
49/PT5	H7CDF	0 ng/g	INCIN.	ASH	GS
49/PT5	OCDF	0 ng/g	INCIN.	ASH	GS
49/PT6	TCDD	0 ng/g	INCIN.	ASH	GS
49/PT6	P5CDD	0 ng/g	INCIN.	ASH	GS
49/PT6	H6CDD	0 ng/g	INCIN.	ASH	GS
49/PT6	H7CDD	0 ng/g	INCIN.	ASH	GS
49/PT6	OCDD	0 ng/g	INCIN.	ASH	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT6	TCDF	0 ng/g	INCIN.	ASH	GS
49/PT6	P5CDF	0 ng/g	INCIN.	ASH	GS
49/PT6	H6CDF	0 ng/g	INCIN.	ASH	GS
49/PT6	H7CDF	0 ng/g	INCIN.	ASH	GS
49/PT6	OCDF	0 ng/g	INCIN.	ASH	GS
49/PT7	TCDD	0 ng/g	INCIN.	ASH	GS
49/PT7	P5CDD	0 ng/g	INCIN.	ASH	GS
49/PT7	H6CDD	0 ng/g	INCIN.	ASH	GS
49/PT7	H7CDD	0 ng/g	INCIN.	ASH	GS
49/PT7	OCDD	0 ng/g	INCIN.	ASH	GS
49/PT7	TCDF	0 ng/g	INCIN.	ASH	GS
49/PT7	P5CDF	0 ng/g	INCIN.	ASH	GS
49/PT7	H6CDF	0 ng/g	INCIN.	ASH	GS
49/PT7	H7CDF	0 ng/g	INCIN.	ASH	GS
49/PT7	OCDF	0 ng/g	INCIN.	ASH	GS
49/PT5	TCDD	56 ng/g	BOILER	ASH	GS
49/PT5	P5CDD	22 ng/g	BOILER	ASH	GS
49/PT5	H6CDD	17 ng/g	BOILER	ASH	GS
49/PT5	H7CDD	11 ng/g	BOILER	ASH	GS
49/PT5	OCDD	51 ng/g	BOILER	ASH	GS
49/PT5	TCDF	2 ng/g	BOILER	ASH	GS
49/PT5	P5CDF	4 ng/g	BOILER	ASH	GS
49/PT5	H6CDF	5 ng/g	BOILER	ASH	GS
49/PT5	H7CDF	9 ng/g	BOILER	ASH	GS
49/PT5	OCDF	3 ng/g	BOILER	ASH	GS
49/PT6	TCDD	150 ng/g	BOILER	ASH	GS
49/PT6	P5CDD	48 ng/g	BOILER	ASH	GS
49/PT6	H6CDD	33 ng/g	BOILER	ASH	GS
49/PT6	H7CDD	11 ng/g	BOILER	ASH	GS
49/PT6	OCDD	38 ng/g	BOILER	ASH	GS
49/PT6	TCDF	3 ng/g	BOILER	ASH	GS
49/PT6	P5CDF	4 ng/g	BOILER	ASH	GS
49/PT6	H6CDF	5 ng/g	BOILER	ASH	GS
49/PT6	H7CDF	9 ng/g	BOILER	ASH	GS
49/PT6	OCDF	3 ng/g	BOILER	ASH	GS
49/PT7	TCDD	5 ng/g	BOILER	ASH	GS
49/PT7	P5CDD	4 ng/g	BOILER	ASH	GS
49/PT7	H6CDD	2 ng/g	BOILER	ASH	GS
49/PT7	H7CDD	2 ng/g	BOILER	ASH	GS
49/PT7	OCDD	6 ng/g	BOILER	ASH	GS
49/PT7	TCDF	1 ng/g	BOILER	ASH	GS
49/PT7	P5CDF	1 ng/g	BOILER	ASH	GS
49/PT7	H6CDF	1 ng/g	BOILER	ASH	GS
49/PT7	H7CDF	2 ng/g	BOILER	ASH	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT7	OCDF	1 ng/g	BOILER	ASH	GS
49/PT5	TCDD	2 ng/g	ECONOM.	ASH	GS
49/PT5	P5CDD	4 ng/g	ECONOM.	ASH	GS
49/PT5	H6CDD	13 ng/g	ECONOM.	ASH	GS
49/PT5	H7CDD	20 ng/g	ECONOM.	ASH	GS
49/PT5	OCDD	45 ng/g	ECONOM.	ASH	GS
49/PT5	TCDF	2 ng/g	ECONOM.	ASH	GS
49/PT5	P5CDF	6 ng/g	ECONOM.	ASH	GS
49/PT5	H6CDF	8 ng/g	ECONOM.	ASH	GS
49/PT5	H7CDF	10 ng/g	ECONOM.	ASH	GS
49/PT5	OCDF	3 ng/g	ECONOM.	ASH	GS
49/PT6	TCDD	1 ng/g	ECONOM.	ASH	GS
49/PT6	P5CDD	2 ng/g	ECONOM.	ASH	GS
49/PT6	H6CDD	5 ng/g	ECONOM.	ASH	GS
49/PT6	H7CDD	8 ng/g	ECONOM.	ASH	GS
49/PT6	OCDD	15 ng/g	ECONOM.	ASH	GS
49/PT6	TCDF	1 ng/g	ECONOM.	ASH	GS
49/PT6	P5CDF	2 ng/g	ECONOM.	ASH	GS
49/PT6	H6CDF	3 ng/g	ECONOM.	ASH	GS
49/PT6	H7CDF	6 ng/g	ECONOM.	ASH	GS
49/PT6	OCDF	1 ng/g	ECONOM.	ASH	GS
49/PT7	TCDD	4 ng/g	ECONOM.	ASH	GS
49/PT7	P5CDD	15 ng/g	ECONOM.	ASH	GS
49/PT7	H6CDD	43 ng/g	ECONOM.	ASH	GS
49/PT7	H7CDD	78 ng/g	ECONOM.	ASH	GS
49/PT7	OCDD	140 ng/g	ECONOM.	ASH	GS
49/PT7	TCDF	6 ng/g	ECONOM.	ASH	GS
49/PT7	P5CDF	14 ng/g	ECONOM.	ASH	GS
49/PT7	H6CDF	19 ng/g	ECONOM.	ASH	GS
49/PT7	H7CDF	22 ng/g	ECONOM.	ASH	GS
49/PT7	OCDF	7 ng/g	ECONOM.	ASH	GS
49/PT8	TCDD	1 ng/nm3	STACK	FG	MM5T
49/PT8	P5CDD	6 ng/nm3	STACK	FG	MM5T
49/PT8	H6CDD	9 ng/nm3	STACK	FG	MM5T
49/PT8	H7CDD	16 ng/nm3	STACK	FG	MM5T
49/PT8	OCDD	26 ng/nm3	STACK	FG	MM5T
49/PT8	TCDF	8 ng/nm3	STACK	FG	MM5T
49/PT8	P5CDF	14 ng/nm3	STACK	FG	MM5T
49/PT8	H6CDF	18 ng/nm3	STACK	FG	MM5T
49/PT8	H7CDF	17 ng/nm3	STACK	FG	MM5T

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT8	OCDF	3 ng/nm3	STACK	FG	MM5T
49/PT9	TCDD	2 ng/nm3	STACK	FG	MM5T
49/PT9	P5CDD	9 ng/nm3	STACK	FG	MM5T
49/PT9	H6CDD	12 ng/nm3	STACK	FG	MM5T
49/PT9	H7CDD	23 ng/nm3	STACK	FG	MM5T
49/PT9	OCDD	25 ng/nm3	STACK	FG	MM5T
49/PT9	TCDF	18 ng/nm3	STACK	FG	MM5T
49/PT9	P5CDF	34 ng/nm3	STACK	FG	MM5T
49/PT9	H6CDF	45 ng/nm3	STACK	FG	MM5T
49/PT9	H7CDF	34 ng/nm3	STACK	FG	MM5T
49/PT9	OCDF	4 ng/nm3	STACK	FG	MM5T
49/PT10	TCDD	1 ng/nm3	STACK	FG	MM5T
49/PT10	P5CDD	5 ng/nm3	STACK	FG	MM5T
49/PT10	H6CDD	10 ng/nm3	STACK	FG	MM5T
49/PT10	H7CDD	17 ng/nm3	STACK	FG	MM5T
49/PT10	OCDD	26 ng/nm3	STACK	FG	MM5T
49/PT10	TCDF	10 ng/nm3	STACK	FG	MM5T
49/PT10	P5CDF	21 ng/nm3	STACK	FG	MM5T
49/PT10	H6CDF	32 ng/nm3	STACK	FG	MM5T
49/PT10	H7CDF	25 ng/nm3	STACK	FG	MM5T
49/PT10	OCDF	3 ng/nm3	STACK	FG	MM5T
49/PT8	TCDD	0 ng/nm3	BOILER	FG	MM5T
49/PT8	P5CDD	0 ng/nm3	BOILER	FG	MM5T
49/PT8	H6CDD	0 ng/nm3	BOILER	FG	MM5T
49/PT8	H7CDD	0 ng/nm3	BOILER	FG	MM5T
49/PT8	OCDD	1 ng/nm3	BOILER	FG	MM5T
49/PT8	TCDF	0 ng/nm3	BOILER	FG	MM5T
49/PT8	P5CDF	0 ng/nm3	BOILER	FG	MM5T
49/PT8	H6CDF	0 ng/nm3	BOILER	FG	MM5T
49/PT8	H7CDF	0 ng/nm3	BOILER	FG	MM5T
49/PT8	OCDF	10 ng/nm3	BOILER	FG	MM5T
49/PT9	TCDD	0 ng/nm3	BOILER	FG	MM5T
49/PT9	P5CDD	0 ng/nm3	BOILER	FG	MM5T
49/PT9	H6CDD	0 ng/nm3	BOILER	FG	MM5T
49/PT9	H7CDD	0 ng/nm3	BOILER	FG	MM5T
49/PT9	OCDD	0 ng/nm3	BOILER	FG	MM5T
49/PT9	TCDF	0 ng/nm3	BOILER	FG	MM5T
49/PT9	P5CDF	0 ng/nm3	BOILER	FG	MM5T
49/PT9	H6CDF	0 ng/nm3	BOILER	FG	MM5T
49/PT9	H7CDF	0 ng/nm3	BOILER	FG	MM5T
49/PT9	OCDF	11 ng/nm3	BOILER	FG	MM5T

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT10	TCDD	0 ng/nm3	BOILER	FG	MM5T
49/PT10	P5CDD	0 ng/nm3	BOILER	FG	MM5T
49/PT10	H6CDD	0 ng/nm3	BOILER	FG	MM5T
49/PT10	H7CDD	0 ng/nm3	BOILER	FG	MM5T
49/PT10	OCDD	3 ng/nm3	BOILER	FG	MM5T
49/PT10	TCDF	0 ng/nm3	BOILER	FG	MM5T
49/PT10	P5CDF	0 ng/nm3	BOILER	FG	MM5T
49/PT10	H6CDF	0 ng/nm3	BOILER	FG	MM5T
49/PT10	H7CDF	0 ng/nm3	BOILER	FG	MM5T
49/PT10	OCDF	7 ng/nm3	BOILER	FG	MM5T
49/PT8	TCDD	0 ng/nm3	-----	GARBAGE	GS
49/PT8	P5CDD	0 ng/nm3	-----	GARBAGE	GS
49/PT8	H6CDD	0 ng/nm3	-----	GARBAGE	GS
49/PT8	H7CDD	0 ng/nm3	-----	GARBAGE	GS
49/PT8	OCDD	0.8 ng/nm3	-----	GARBAGE	GS
49/PT8	TCDF	0 ng/nm3	-----	GARBAGE	GS
49/PT8	P5CDF	0 ng/nm3	-----	GARBAGE	GS
49/PT8	H6CDF	0 ng/nm3	-----	GARBAGE	GS
49/PT8	H7CDF	0 ng/nm3	-----	GARBAGE	GS
49/PT8	OCDF	0 ng/nm3	-----	GARBAGE	GS
49/PT9	TCDD	0 ng/nm3	-----	GARBAGE	GS
49/PT9	P5CDD	0 ng/nm3	-----	GARBAGE	GS
49/PT9	H6CDD	0 ng/nm3	-----	GARBAGE	GS
49/PT9	H7CDD	0 ng/nm3	-----	GARBAGE	GS
49/PT9	OCDD	1.1 ng/nm3	-----	GARBAGE	GS
49/PT9	TCDF	0 ng/nm3	-----	GARBAGE	GS
49/PT9	P5CDF	0 ng/nm3	-----	GARBAGE	GS
49/PT9	H6CDF	0 ng/nm3	-----	GARBAGE	GS
49/PT9	H7CDF	0 ng/nm3	-----	GARBAGE	GS
49/PT9	OCDF	0 ng/nm3	-----	GARBAGE	GS
49/PT10	TCDD	0 ng/nm3	-----	GARBAGE	GS
49/PT10	P5CDD	0 ng/nm3	-----	GARBAGE	GS
49/PT10	H6CDD	0 ng/nm3	-----	GARBAGE	GS
49/PT10	H7CDD	0 ng/nm3	-----	GARBAGE	GS
49/PT10	OCDD	1.1 ng/nm3	-----	GARBAGE	GS
49/PT10	TCDF	0 ng/nm3	-----	GARBAGE	GS
49/PT10	P5CDF	0 ng/nm3	-----	GARBAGE	GS
49/PT10	H6CDF	0 ng/nm3	-----	GARBAGE	GS
49/PT10	H7CDF	0 ng/nm3	-----	GARBAGE	GS
49/PT10	OCDF	0 ng/nm3	-----	GARBAGE	GS
49/PT8	TCDD	0 ng/g	INCIN.	ASH	GS
49/PT8	P5CDD	0 ng/g	INCIN.	ASH	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT8	H6CDD	0 ng/g	INCIN.	ASH	GS
49/PT8	H7CDD	0 ng/g	INCIN.	ASH	GS
49/PT8	OCDD	0 ng/g	INCIN.	ASH	GS
49/PT8	TCDF	0 ng/g	INCIN.	ASH	GS
49/PT8	P5CDF	0 ng/g	INCIN.	ASH	GS
49/PT8	H6CDF	0 ng/g	INCIN.	ASH	GS
49/PT8	H7CDF	0 ng/g	INCIN.	ASH	GS
49/PT8	OCDF	0 ng/g	INCIN.	ASH	GS
49/PT9	TCDD	0 ng/g	INCIN.	ASH	GS
49/PT9	P5CDD	0 ng/g	INCIN.	ASH	GS
49/PT9	H6CDD	0 ng/g	INCIN.	ASH	GS
49/PT9	H7CDD	0 ng/g	INCIN.	ASH	GS
49/PT9	OCDD	0 ng/g	INCIN.	ASH	GS
49/PT9	TCDF	0 ng/g	INCIN.	ASH	GS
49/PT9	P5CDF	0 ng/g	INCIN.	ASH	GS
49/PT9	H6CDF	0 ng/g	INCIN.	ASH	GS
49/PT9	H7CDF	0 ng/g	INCIN.	ASH	GS
49/PT9	OCDF	0 ng/g	INCIN.	ASH	GS
49/PT10	TCDD	0 ng/g	INCIN.	ASH	GS
49/PT10	P5CDD	0 ng/g	INCIN.	ASH	GS
49/PT10	H6CDD	0 ng/g	INCIN.	ASH	GS
49/PT10	H7CDD	0 ng/g	INCIN.	ASH	GS
49/PT10	OCDD	0 ng/g	INCIN.	ASH	GS
49/PT10	TCDF	0 ng/g	INCIN.	ASH	GS
49/PT10	P5CDF	0 ng/g	INCIN.	ASH	GS
49/PT10	H6CDF	0 ng/g	INCIN.	ASH	GS
49/PT10	H7CDF	0 ng/g	INCIN.	ASH	GS
49/PT10	OCDF	0 ng/g	INCIN.	ASH	GS
49/PT8	TCDD	60 ng/g	BOILER	ASH	GS
49/PT8	P5CDD	14 ng/g	BOILER	ASH	GS
49/PT8	H6CDD	9 ng/g	BOILER	ASH	GS
49/PT8	H7CDD	5 ng/g	BOILER	ASH	GS
49/PT8	OCDD	10 ng/g	BOILER	ASH	GS
49/PT8	TCDF	1 ng/g	BOILER	ASH	GS
49/PT8	P5CDF	2 ng/g	BOILER	ASH	GS
49/PT8	H6CDF	2 ng/g	BOILER	ASH	GS
49/PT8	H7CDF	3 ng/g	BOILER	ASH	GS
49/PT8	OCDF	1 ng/g	BOILER	ASH	GS
49/PT9	TCDD	21 ng/g	BOILER	ASH	GS
49/PT9	P5CDD	13 ng/g	BOILER	ASH	GS
49/PT9	H6CDD	9 ng/g	BOILER	ASH	GS
49/PT9	H7CDD	3 ng/g	BOILER	ASH	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT10	P5CDF	8 ng/g	ECONOM.	ASH	GS
49/PT10	H6CDF	16 ng/g	ECONOM.	ASH	GS
49/PT10	H7CDF	13 ng/g	ECONOM.	ASH	GS
49/PT10	OCDF	4 ng/g	ECONOM.	ASH	GS
49/PT11	TCDD	2 ng/nm3	STACK	FG	MM5T
49/PT11	P5CDD	9 ng/nm3	STACK	FG	MM5T
49/PT11	H6CDD	18 ng/nm3	STACK	FG	MM5T
49/PT11	H7CDD	40 ng/nm3	STACK	FG	MM5T
49/PT11	OCDD	79 ng/nm3	STACK	FG	MM5T
49/PT11	TCDF	11 ng/nm3	STACK	FG	MM5T
49/PT11	P5CDF	23 ng/nm3	STACK	FG	MM5T
49/PT11	H6CDF	35 ng/nm3	STACK	FG	MM5T
49/PT11	H7CDF	36 ng/nm3	STACK	FG	MM5T
49/PT11	OCDF	10 ng/nm3	STACK	FG	MM5T
49/PT12	TCDD	5 ng/nm3	STACK	FG	MM5T
49/PT12	P5CDD	9 ng/nm3	STACK	FG	MM5T
49/PT12	H6CDD	19 ng/nm3	STACK	FG	MM5T
49/PT12	H7CDD	39 ng/nm3	STACK	FG	MM5T
49/PT12	OCDD	69 ng/nm3	STACK	FG	MM5T
49/PT12	TCDF	18 ng/nm3	STACK	FG	MM5T
49/PT12	P5CDF	25 ng/nm3	STACK	FG	MM5T
49/PT12	H6CDF	31 ng/nm3	STACK	FG	MM5T
49/PT12	H7CDF	30 ng/nm3	STACK	FG	MM5T
49/PT12	OCDF	8 ng/nm3	STACK	FG	MM5T
49/PT13	TCDD	3 ng/nm3	STACK	FG	MM5T
49/PT13	P5CDD	6 ng/nm3	STACK	FG	MM5T
49/PT13	H6CDD	12 ng/nm3	STACK	FG	MM5T
49/PT13	H7CDD	22 ng/nm3	STACK	FG	MM5T
49/PT13	OCDD	37 ng/nm3	STACK	FG	MM5T
49/PT13	TCDF	11 ng/nm3	STACK	FG	MM5T
49/PT13	P5CDF	15 ng/nm3	STACK	FG	MM5T
49/PT13	H6CDF	19 ng/nm3	STACK	FG	MM5T
49/PT13	H7CDF	18 ng/nm3	STACK	FG	MM5T
49/PT13	OCDF	4 ng/nm3	STACK	FG	MM5T
49/PT11	TCDD	0 ng/nm3	BOILER	FG	MM5T
49/PT11	P5CDD	0 ng/nm3	BOILER	FG	MM5T
49/PT11	H6CDD	0 ng/nm3	BOILER	FG	MM5T
49/PT11	H7CDD	0 ng/nm3	BOILER	FG	MM5T
49/PT11	OCDD	0 ng/nm3	BOILER	FG	MM5T
49/PT11	TCDF	0 ng/nm3	BOILER	FG	MM5T
49/PT11	P5CDF	0 ng/nm3	BOILER	FG	MM5T
49/PT11	H6CDF	0 ng/nm3	BOILER	FG	MM5T

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT11	H7CDF	0 ng/nm3	BOILER	FG	MM5T
49/PT11	OCDF	7 ng/nm3	BOILER	FG	MM5T
49/PT12	TCDD	0 ng/nm3	BOILER	FG	MM5T
49/PT12	P5CDD	0 ng/nm3	BOILER	FG	MM5T
49/PT12	H6CDD	0 ng/nm3	BOILER	FG	MM5T
49/PT12	H7CDD	0 ng/nm3	BOILER	FG	MM5T
49/PT12	OCDD	1 ng/nm3	BOILER	FG	MM5T
49/PT12	TCDF	0 ng/nm3	BOILER	FG	MM5T
49/PT12	P5CDF	0 ng/nm3	BOILER	FG	MM5T
49/PT12	H6CDF	0 ng/nm3	BOILER	FG	MM5T
49/PT12	H7CDF	0 ng/nm3	BOILER	FG	MM5T
49/PT12	OCDF	8 ng/nm3	BOILER	FG	MM5T
49/PT13	TCDD	6 ng/nm3	BOILER	FG	MM5T
49/PT13	P5CDD	2 ng/nm3	BOILER	FG	MM5T
49/PT13	H6CDD	5 ng/nm3	BOILER	FG	MM5T
49/PT13	H7CDD	11 ng/nm3	BOILER	FG	MM5T
49/PT13	OCDD	15 ng/nm3	BOILER	FG	MM5T
49/PT13	TCDF	0 ng/nm3	BOILER	FG	MM5T
49/PT13	P5CDF	11 ng/nm3	BOILER	FG	MM5T
49/PT13	H6CDF	4 ng/nm3	BOILER	FG	MM5T
49/PT13	H7CDF	15 ng/nm3	BOILER	FG	MM5T
49/PT13	OCDF	13 ng/nm3	BOILER	FG	MM5T
49/PT11	TCDD	0 ng/g	-----	GARBAGE	GS
49/PT11	P5CDD	0 ng/g	-----	GARBAGE	GS
49/PT11	H6CDD	0 ng/g	-----	GARBAGE	GS
49/PT11	H7CDD	0 ng/g	-----	GARBAGE	GS
49/PT11	OCDD	0.6 ng/g	-----	GARBAGE	GS
49/PT11	TCDF	0 ng/g	-----	GARBAGE	GS
49/PT11	P5CDF	0 ng/g	-----	GARBAGE	GS
49/PT11	H6CDF	0 ng/g	-----	GARBAGE	GS
49/PT11	H7CDF	0 ng/g	-----	GARBAGE	GS
49/PT11	OCDF	0 ng/g	-----	GARBAGE	GS
49/PT12	TCDD	3.6 ng/g	-----	GARBAGE	GS
49/PT12	P5CDD	12.5 ng/g	-----	GARBAGE	GS
49/PT12	H6CDD	7.4 ng/g	-----	GARBAGE	GS
49/PT12	H7CDD	3.7 ng/g	-----	GARBAGE	GS
49/PT12	OCDD	0.7 ng/g	-----	GARBAGE	GS
49/PT12	TCDF	0 ng/g	-----	GARBAGE	GS
49/PT12	P5CDF	0 ng/g	-----	GARBAGE	GS
49/PT12	H6CDF	0 ng/g	-----	GARBAGE	GS
49/PT12	H7CDF	0 ng/g	-----	GARBAGE	GS
49/PT12	OCDF	0 ng/g	-----	GARBAGE	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT9	OCDD	4 ng/g	BOILER	ASH	GS
49/PT9	TCDF	1 ng/g	BOILER	ASH	GS
49/PT9	P5CDF	1 ng/g	BOILER	ASH	GS
49/PT9	H6CDF	2 ng/g	BOILER	ASH	GS
49/PT9	H7CDF	1 ng/g	BOILER	ASH	GS
49/PT9	OCDF	0 ng/g	BOILER	ASH	GS
49/PT10	TCDD	4 ng/g	BOILER	ASH	GS
49/PT10	P5CDD	3 ng/g	BOILER	ASH	GS
49/PT10	H6CDD	3 ng/g	BOILER	ASH	GS
49/PT10	H7CDD	3 ng/g	BOILER	ASH	GS
49/PT10	OCDD	6 ng/g	BOILER	ASH	GS
49/PT10	TCDF	1 ng/g	BOILER	ASH	GS
49/PT10	P5CDF	1 ng/g	BOILER	ASH	GS
49/PT10	H6CDF	1 ng/g	BOILER	ASH	GS
49/PT10	H7CDF	2 ng/g	BOILER	ASH	GS
49/PT10	OCDF	1 ng/g	BOILER	ASH	GS
49/PT8	TCDD	1 ng/g	ECONOM.	ASH	GS
49/PT8	P5CDD	3 ng/g	ECONOM.	ASH	GS
49/PT8	H6CDD	12 ng/g	ECONOM.	ASH	GS
49/PT8	H7CDD	16 ng/g	ECONOM.	ASH	GS
49/PT8	OCDD	27 ng/g	ECONOM.	ASH	GS
49/PT8	TCDF	3 ng/g	ECONOM.	ASH	GS
49/PT8	P5CDF	6 ng/g	ECONOM.	ASH	GS
49/PT8	H6CDF	7 ng/g	ECONOM.	ASH	GS
49/PT8	H7CDF	9 ng/g	ECONOM.	ASH	GS
49/PT8	OCDF	2 ng/g	ECONOM.	ASH	GS
49/PT9	TCDD	2 ng/g	ECONOM.	ASH	GS
49/PT9	P5CDD	5 ng/g	ECONOM.	ASH	GS
49/PT9	H6CDD	11 ng/g	ECONOM.	ASH	GS
49/PT9	H7CDD	14 ng/g	ECONOM.	ASH	GS
49/PT9	OCDD	20 ng/g	ECONOM.	ASH	GS
49/PT9	TCDF	6 ng/g	ECONOM.	ASH	GS
49/PT9	P5CDF	10 ng/g	ECONOM.	ASH	GS
49/PT9	H6CDF	10 ng/g	ECONOM.	ASH	GS
49/PT9	H7CDF	8 ng/g	ECONOM.	ASH	GS
49/PT9	OCDF	2 ng/g	ECONOM.	ASH	GS
49/PT10	TCDD	1 ng/g	ECONOM.	ASH	GS
49/PT10	P5CDD	4 ng/g	ECONOM.	ASH	GS
49/PT10	H6CDD	22 ng/g	ECONOM.	ASH	GS
49/PT10	H7CDD	33 ng/g	ECONOM.	ASH	GS
49/PT10	OCDD	46 ng/g	ECONOM.	ASH	GS
49/PT10	TCDF	4 ng/g	ECONOM.	ASH	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT13	TCDD	0 ng/g	-----	GARBAGE	GS
49/PT13	P5CDD	0 ng/g	-----	GARBAGE	GS
49/PT13	H6CDD	0 ng/g	-----	GARBAGE	GS
49/PT13	H7CDD	0 ng/g	-----	GARBAGE	GS
49/PT13	OCDD	1.5 ng/g	-----	GARBAGE	GS
49/PT13	TCDF	0 ng/g	-----	GARBAGE	GS
49/PT13	P5CDF	0 ng/g	-----	GARBAGE	GS
49/PT13	H6CDF	0 ng/g	-----	GARBAGE	GS
49/PT13	H7CDF	0 ng/g	-----	GARBAGE	GS
49/PT13	OCDF	0 ng/g	-----	GARBAGE	GS
49/PT11	TCDD	0 ng/g	INCIN.	ASH	GS
49/PT11	P5CDD	0 ng/g	INCIN.	ASH	GS
49/PT11	H6CDD	0 ng/g	INCIN.	ASH	GS
49/PT11	H7CDD	0 ng/g	INCIN.	ASH	GS
49/PT11	OCDD	0 ng/g	INCIN.	ASH	GS
49/PT11	TCDF	0 ng/g	INCIN.	ASH	GS
49/PT11	P5CDF	0 ng/g	INCIN.	ASH	GS
49/PT11	H6CDF	0 ng/g	INCIN.	ASH	GS
49/PT11	H7CDF	0 ng/g	INCIN.	ASH	GS
49/PT11	OCDF	0 ng/g	INCIN.	ASH	GS
49/PT12	TCDD	0 ng/g	INCIN.	ASH	GS
49/PT12	P5CDD	0 ng/g	INCIN.	ASH	GS
49/PT12	H6CDD	0 ng/g	INCIN.	ASH	GS
49/PT12	H7CDD	0 ng/g	INCIN.	ASH	GS
49/PT12	OCDD	0 ng/g	INCIN.	ASH	GS
49/PT12	TCDF	0 ng/g	INCIN.	ASH	GS
49/PT12	P5CDF	0 ng/g	INCIN.	ASH	GS
49/PT12	H6CDF	0 ng/g	INCIN.	ASH	GS
49/PT12	H7CDF	0 ng/g	INCIN.	ASH	GS
49/PT12	OCDF	0 ng/g	INCIN.	ASH	GS
49/PT13	TCDD	0 ng/g	INCIN.	ASH	GS
49/PT13	P5CDD	0 ng/g	INCIN.	ASH	GS
49/PT13	H6CDD	0 ng/g	INCIN.	ASH	GS
49/PT13	H7CDD	0 ng/g	INCIN.	ASH	GS
49/PT13	OCDD	0 ng/g	INCIN.	ASH	GS
49/PT13	TCDF	0 ng/g	INCIN.	ASH	GS
49/PT13	P5CDF	0 ng/g	INCIN.	ASH	GS
49/PT13	H6CDF	0 ng/g	INCIN.	ASH	GS
49/PT13	H7CDF	0 ng/g	INCIN.	ASH	GS
49/PT13	OCDF	0 ng/g	INCIN.	ASH	GS
49/PT11	TCDD	31 ng/g	BOILER	ASH	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT11	P5CDD	20 ng/g	BOILER	ASH	GS
49/PT11	H6CDD	41 ng/g	BOILER	ASH	GS
49/PT11	H7CDD	12 ng/g	BOILER	ASH	GS
49/PT11	OCDD	28 ng/g	BOILER	ASH	GS
49/PT11	TCDF	2 ng/g	BOILER	ASH	GS
49/PT11	P5CDF	3 ng/g	BOILER	ASH	GS
49/PT11	H6CDF	4 ng/g	BOILER	ASH	GS
49/PT11	H7CDF	6 ng/g	BOILER	ASH	GS
49/PT11	OCDF	2 ng/g	BOILER	ASH	GS
49/PT12	TCDD	78 ng/g	BOILER	ASH	GS
49/PT12	P5CDD	51 ng/g	BOILER	ASH	GS
49/PT12	H6CDD	43 ng/g	BOILER	ASH	GS
49/PT12	H7CDD	11 ng/g	BOILER	ASH	GS
49/PT12	OCDD	19 ng/g	BOILER	ASH	GS
49/PT12	TCDF	3 ng/g	BOILER	ASH	GS
49/PT12	P5CDF	4 ng/g	BOILER	ASH	GS
49/PT12	H6CDF	4 ng/g	BOILER	ASH	GS
49/PT12	H7CDF	4 ng/g	BOILER	ASH	GS
49/PT12	OCDF	2 ng/g	BOILER	ASH	GS
49/PT13	TCDD	38 ng/g	BOILER	ASH	GS
49/PT13	P5CDD	26 ng/g	BOILER	ASH	GS
49/PT13	H6CDD	21 ng/g	BOILER	ASH	GS
49/PT13	H7CDD	7 ng/g	BOILER	ASH	GS
49/PT13	OCDD	24 ng/g	BOILER	ASH	GS
49/PT13	TCDF	1 ng/g	BOILER	ASH	GS
49/PT13	P5CDF	2 ng/g	BOILER	ASH	GS
49/PT13	H6CDF	3 ng/g	BOILER	ASH	GS
49/PT13	H7CDF	5 ng/g	BOILER	ASH	GS
49/PT13	OCDF	2 ng/g	BOILER	ASH	GS
49/PT11	TCDD	1 ng/g	ECONOM.	ASH	GS
49/PT11	P5CDD	5 ng/g	ECONOM.	ASH	GS
49/PT11	H6CDD	13 ng/g	ECONOM.	ASH	GS
49/PT11	H7CDD	22 ng/g	ECONOM.	ASH	GS
49/PT11	OCDD	50 ng/g	ECONOM.	ASH	GS
49/PT11	TCDF	3 ng/g	ECONOM.	ASH	GS
49/PT11	P5CDF	6 ng/g	ECONOM.	ASH	GS
49/PT11	H6CDF	8 ng/g	ECONOM.	ASH	GS
49/PT11	H7CDF	9 ng/g	ECONOM.	ASH	GS
49/PT11	OCDF	3 ng/g	ECONOM.	ASH	GS
49/PT12	TCDD	1 ng/g	ECONOM.	ASH	GS
49/PT12	P5CDD	3 ng/g	ECONOM.	ASH	GS
49/PT12	H6CDD	6 ng/g	ECONOM.	ASH	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
49/PT12	H7CDD	11 ng/g	ECONOM.	ASH	GS
49/PT12	OCDD	67 ng/g	ECONOM.	ASH	GS
49/PT12	TCDF	1 ng/g	ECONOM.	ASH	GS
49/PT12	P5CDF	4 ng/g	ECONOM.	ASH	GS
49/PT12	H6CDF	4 ng/g	ECONOM.	ASH	GS
49/PT12	H7CDF	14 ng/g	ECONOM.	ASH	GS
49/PT12	OCDF	5 ng/g	ECONOM.	ASH	GS
49/PT13	TCDD	2 ng/g	ECONOM.	ASH	GS
49/PT13	P5CDD	3 ng/g	ECONOM.	ASH	GS
49/PT13	H6CDD	11 ng/g	ECONOM.	ASH	GS
49/PT13	H7CDD	20 ng/g	ECONOM.	ASH	GS
49/PT13	OCDD	47 ng/g	ECONOM.	ASH	GS
49/PT13	TCDF	2 ng/g	ECONOM.	ASH	GS
49/PT13	P5CDF	5 ng/g	ECONOM.	ASH	GS
49/PT13	H6CDF	8 ng/g	ECONOM.	ASH	GS
49/PT13	H7CDF	10 ng/g	ECONOM.	ASH	GS
49/PT13	OCDF	4 ng/g	ECONOM.	ASH	GS
51	DATA ARE CONFIDENTIAL				
69	TCDD	13.5 ppb	ESP	FA	WEEKLY GS
69	P5CDD	23.2 ppb	ESP	FA	WEEKLY GS
69	H6CDD	25.8 ppb	ESP	FA	WEEKLY GS
69	H7CDD	14.9 ppb	ESP	FA	WEEKLY GS
69	OCDD	6.3 ppb	ESP	FA	WEEKLY GS
70	TCDD	8.6 ppb	ESP	FA	GS
70	P5CDD	15 ppb	ESP	FA	GS
70	H6CDD	13 ppb	ESP	FA	GS
70	H7CDD	3.2 ppb	ESP	FA	GS
70	OCDD	0.4 ppb	ESP	FA	GS
71/Jap(#1)	TCDD	4.8 ng/g	ESP	FA	GS
71/Jap(#2)	TCDD	8.5 ng/g	ESP	FA	GS
71/Net	TCDD	2.4 ng/g	ESP	FA	GS
71/Ont(#1)	TCDD	12 ng/g	ESP	FA	GS
71/Ont(#2)	TCDD	9.3 ng/g	ESP	FA	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
87/WET	TCDD	905 ng/Ncm	Stack	FG	TRAIN
87/WET	P5CDD	1395 ng/Ncm	Stack	FG	TRAIN
87/WET	H6CDD	2598 ng/Ncm	Stack	FG	TRAIN
87/WET	H7CDD	1964 ng/Ncm	Stack	FG	TRAIN
87/WET	OCDD	498 ng/Ncm	Stack	FG	TRAIN
87/Normal	TCDD	26 ng/Ncm	Stack	FG	TRAIN
87/Normal	P5CDD	NA ng/Ncm	Stack	FG	TRAIN
87/Normal	H6CDD	68.4 ng/Ncm	Stack	FG	TRAIN
87/Normal	H7CDD	62 ng/Ncm	Stack	FG	TRAIN
87/Normal	OCDD	76 ng/Ncm	Stack	FG	TRAIN
87/Normal	TCDF	309 ng/Ncm	Stack	FG	TRAIN
87/Normal	P5CDF	250.3 ng/Ncm	Stack	FG	TRAIN
87/Normal	H6CDF	314.2 ng/Ncm	Stack	FG	TRAIN
87/Normal	H7CDF	215.1 ng/Ncm	Stack	FG	TRAIN
87/Normal	OCDF	123.8 ng/Ncm	Stack	FG	TRAIN
90	TCDD	45 ppt	Furnace	Ash	GS
90	TCDD	10000 ppt	Stack	FA	GS
90	TCDF	45000 ppt	Stack	FA	GS
90	TCDF	2000 ppt	Furnace	Ash	GS
92	TCDD	230 ng/dscm	Stack	FG	MM5T
92	P5CDD	1200 ng/dscm	Stack	FG	MM5T
92	H6CDD	[illegible] ng/dscm	Stack	FG	MM5T
92	H7CDD	160 ng/dscm	Stack	FG	MM5T
92	OCDD	41 ng/dscm	Stack	FG	MM5T
92	TCDF	1100 ng/dscm	Stack	FG	MM5T
92	P5CDF	6200 ng/dscm	Stack	FG	MM5T
92	H6CDF	700 ng/dscm	Stack	FG	MM5T
92	H7CDF	200 ng/dscm	Stack	FG	MM5T
92	OCDF	14 ng/dscm	Stack	FG	MM5T
92	TCDD	170 ng/g	ESP	FA	GS
92	P5CDD	[illegible] ng/g	ESP	FA	GS
92	H6CDD	52 ng/g	ESP	FA	GS
92	H7CDD	7.4 ng/g	ESP	FA	GS
92	OCDD	2.6 ng/g	ESP	FA	GS
92	TCDF	410 ng/g	ESP	FA	GS
92	P5CDF	1800 ng/g	ESP	FA	GS
92	H6CDF	[illegible] ng/g	ESP	FA	GS
92	H7CDF	9.5 ng/g	ESP	FA	GS
92	OCDF	1.4 ng/g	ESP	FA	GS
97	2,3,7,8 T	1.94 ng	Stack	FG	TRAIN
97	TCDD	31.46 ng	Stack	FG	TRAIN
97	H6CDD	42.2 ng	Stack	FG	TRAIN
97	H7CDD	10 ng	Stack	FG	TRAIN
97	OCDD	ND	Stack	FG	TRAIN

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
100	2,3,7,8 T	1.05 ng/m3	Stack	FG	MM5T
100	2,3,7,8 T	0.295 ng/m3	Stack	FG	MM5T
100	2,3,7,8 T	9.1 ng/m3	Stack	FG	MM5T
100	2,3,7,8 T	99.5 ng/m3	Stack	FG	MM5T
100	2,3,7,8 T	10.3 ng/m3	Stack	FG	MM5T
100	2,3,7,8 T	5.4 ng/m3	Stack	FG	MM5T
100	TCDD	3.15 ng/m3	Stack	FG	MM5T
100	TCDD	1.2 ng/m3	Stack	FG	MM5T
100	TCDD	29.7 ng/m3	Stack	FG	MM5T
100	TCDD	ND	-----	Feed	GS
100	TCDF	279.5 ng/m3	Stack	FG	MM5T
100	TCDF	11.1 ng/m3	Stack	FG	MM5T
100	TCDF	21 ng/m3	Stack	FG	MM5T
100	TCDF	ND	-----	Feed	GS
101/RDF/1	2378-TCDD	2.1 ng/dscm	STACK	PART.	MM5T
101/RDF/1	TCDD	79 ng/dscm	STACK	PART.	MM5T
101/RDF/1	2378-TCDF	NA	STACK	PART.	MM5T
101/RDF/1	TCDF	62 ng/dscm	STACK	PART.	MM5T
101/RDF/1	2378-TCDD	0.3 ng/dscm	STACK	FG	MM5T
101/RDF/1	TCDD	4 ng/dscm	STACK	FG	MM5T
101/RDF/1	2378-TCDF	NA	STACK	FG	MM5T
101/RDF/1	TCDF	17 ng/dscm	STACK	FG	MM5T
101/RDF/2	2378-TCDD	12.2 ng/dscm	STACK	PART.	MM5T
101/RDF/2	TCDD	142 ng/dscm	STACK	PART.	MM5T
101/RDF/2	2378-TCDF	NA	STACK	PART.	MM5T
101/RDF/2	TCDF	27 ng/dscm	STACK	PART.	MM5T
101/RDF/2	2378-TCDD	11.3 ng/dscm	STACK	FG	MM5T
101/RDF/2	TCDD	228 ng/dscm	STACK	FG	MM5T
101/RDF/2	2378-TCDF	NA	STACK	FG	MM5T
101/RDF/2	TCDF	1055 ng/dscm	STACK	FG	MM5T
101/RDF/3	2378-TCDD	1.9 ng/dscm	STACK	PART.	MM5T
101/RDF/3	TCDD	46 ng/dscm	STACK	PART.	MM5T
101/RDF/3	2378-TCDF	NA	STACK	PART.	MM5T
101/RDF/3	TCDF	86 ng/dscm	STACK	PART.	MM5T
101/RDF/3	2378-TCDD	1.7 ng/dscm	STACK	FG	MM5T
101/RDF/3	TCDD	22 ng/dscm	STACK	FG	MM5T
101/RDF/3	2378-TCDF	NA	STACK	FG	MM5T
101/RDF/3	TCDF	128 ng/dscm	STACK	FG	MM5T

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
101/MB/1	2378-TCDD	42 ng/dscm	STACK	PART.	MM5T
101/MB/1	TCDD	167 ng/dscm	STACK	PART.	MM5T
101/MB/1	2378-TCDF	27 ng/dscm	STACK	PART.	MM5T
101/MB/1	TCDF	137 ng/dscm	STACK	PART.	MM5T
101/MB/1	2378-TCDD	20 ng/dscm	STACK	FG (XAD)	MM5T
101/MB/1	TCDD	63 ng/dscm	STACK	FG (XAD)	MM5T
101/MB/1	2378-TCDF	32 ng/dscm	STACK	FG (XAD)	MM5T
101/MB/1	TCDF	172 ng/dscm	STACK	FG (XAD)	MM5T
101/MB/2	2378-TCDD	95 ng/dscm	STACK	PART.+ FG	MM5T
101/MB/2	TCDD	550 ng/dscm	STACK	PART.+ FG	MM5T
101/MB/2	2378-TCDF	112 ng/dscm	STACK	PART.+ FG	MM5T
101/MB/2	TCDF	577 ng/dscm	STACK	PART.+ FG	MM5T
101/MB/3	2378-TCDD	33 ng/dscm	STACK	PART.+ FG	MM5T
101/MB/3	TCDD	155 ng/dscm	STACK	PART.+ FG	MM5T
101/MB/3	2378-TCDF	48 ng/dscm	STACK	PART.+ FG	MM5T
101/MB/3	TCDF	268 ng/dscm	STACK	PART.+ FG	MM5T
101/MOD/1	2378-TCDD	0.2 ng/dscm	STACK	PART.+ FG	MM5T
101/MOD/1	TCDD	3.3 ng/dscm	STACK	PART.+ FG	MM5T
101/MOD/1	2378-TCDF	NA	STACK	PART.+ FG	MM5T
101/MOD/1	TCDF	18 ng/dscm	STACK	PART.+ FG	MM5T
101/MOD/2	2378-TCDD	0.05 ng/dscm	STACK	PART.	MM5T
101/MOD/2	TCDD	1.1 ng/dscm	STACK	PART.	MM5T
101/MOD/2	2378-TCDF	NA	STACK	PART.	MM5T
101/MOD/2	TCDF	6 ng/dscm	STACK	PART.	MM5T
101/MOD/2	2378-TCDD	1.5 ng/dscm	STACK	FG	MM5T
101/MOD/2	TCDD	18 ng/dscm	STACK	FG	MM5T
101/MOD/2	2378-TCDF	NA	STACK	FG	MM5T
101/MOD/2	TCDF	121 ng/dscm	STACK	FG	MM5T
109	PCDD	N/A	stack	FG/FA	Train
109	TCDF	N/A	stack	FG/FA	Train
109	PCDF	N/A	stack	FG/FA	Train
109	TCDD	N/A	stack	FG/FA	Train
115	2,3,7,8 T DD	ND	ESP	FA	GS
115	2,3,7,8 T DD	ND	Grate	ASH	GS
115	2,3,7,8 T DD	ND	Stack	FG	SSAS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
116	TCDD	275 ng/g	ESP	FA	GS
116	P5CDD	7.8 ng/g	ESP	FA	GS
116	H6CDD	21.8 ng/g	ESP	FA	GS
116	H7CDD	62.4 ng/g	ESP	FA	GS
116	OCDD	185.8 ng/g	ESP	FA	GS
118/1	TCDD	ND	ESP	ASH	GS
118/1	P5CDD	8 ng/g	ESP	ASH	GS
118/1	H6CDD	28 ng/g	ESP	ASH	GS
118/1	H7CDD	75 ng/g	ESP	ASH	GS
118/1	OCDD	180 ng/g	ESP	ASH	GS
118/2	TCDD	ND	ESP	ASH	GS
118/2	P5CDD	7 ng/g	ESP	ASH	GS
118/2	H6CDD	25 ng/g	ESP	ASH	GS
118/2	H7CDD	74 ng/g	ESP	ASH	GS
118/2	OCDD	140 ng/g	ESP	ASH	GS
143	TCDD	Trac.	Furnace	Ash	GS
143	P5CDD	4 ng/g	Furnace	Ash	GS
143	H6CDD	16 ng/g	Furnace	Ash	GS
143	H7CDD	16 ng/g	Furnace	Ash	GS
143	OCDD	35 ng/g	Furnace	Ash	GS
143	TCDD	40 ng/g	Stack	FA	GS
143	P5CDD	110 ng/g	Stack	FA	GS
143	H6CDD	340 ng/g	Stack	FA	GS
143	H7CDD	900 ng/g	Stack	FA	GS
143	OCDD	900 ng/g	Stack	FA	GS
143	TCDD	Trac.	ESP	FA	GS
143	P5CDD	6 ng/g	ESP	FA	GS
143	H7CDD	55 ng/g	ESP	FA	GS
143	H6CDD	53 ng/g	ESP	FA	GS
143	OCDD	50 ng/g	ESP	FA	GS
144/Bol	TCDD/TCDF	112 ppb	ESP	FA	GS
144/Bol	P5CDD/P5C	205 ppb	ESP	FA	GS
144/Bol	H6CDD/H6C	[illegible] ppb	ESP	FA	GS
144/Bol	H7CDD/H7C	345 ppb	ESP	FA	GS
144/Bol	OCDD/OCDF	425 ppb	ESP	FA	GS
144/Bol	TCDD/TCDF	16 ppb	Furnace	Ash	GS
144/Bol	P5CDD/P5C	20 ppb	Furnace	Ash	GS
144/Bol	H6CDD/H6C	33 ppb	Furnace	Ash	GS
144/Bol	H7CDD/H7C	113 ppb	Furnace	Ash	GS
144/Bol	OCDD/OCDF	390 ppb	Furnace	Ash	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
144/Flo	TCDD/TCDF	175 ppb	Stack	FA	N/A
144/Flo	P5CDD/DF	240 ppb	Stack	FA	N/A
144/Flo	H6CDD/DF	185 ppb	Stack	FA	N/A
144/Flo	H7CDD/DF	400 ppb	Stack	FA	N/A
144/Flo	OCDD/OCDF	570 ppb	Stack	FA	N/A
144/Flo	TCDD/TCDF	ND	Stack	FG	N/A
144/Flo	6P5CDD/DF	ND	Stack	FG	N/A
144/Flo	H6CDD/DF	125 ppb	Stack	FG	N/A
144/Flo	H7CDD/DF	105 ppb	Stack	FG	N/A
144/Flo	OCDD/OCDF	31 ppb	Stack	FG	N/A
144/Mil	TCDD/TCDF	51 ppb	ESP	FA	GS
144/Mil	P5CDD/P5C	115 ppb	ESP	FA	GS
144/Mil	H6CDD/H6C	177 ppb	ESP	FA	GS
144/Mil	H7CDD/H7C	310 ppb	ESP	FA	GS
144/Mil	OCDD/OCDF	547 ppb	ESP	FA	GS
144/A	TCDD	20 ppb	ESP	FA	GS
144/A	P5CDD	100 ppb	ESP	FA	GS
144/A	H6CDD	160 ppb	ESP	FA	GS
144/A	H7CDD	230 ppb	ESP	FA	GS
144/A	OCDD	490 ppb	ESP	FA	GS
144/A	H7CDF	70 ppb	ESP	FA	GS
144/A	OCDF	50 ppb	ESP	FA	GS
144/A	TCDD	16 ppb	Furnace	Ash	GS
144/A	P5CDD	20 ppb	Furnace	Ash	GS
144/A	H6CDD	33 ppb	Furnace	Ash	GS
144/A	H7CDD	90 ppb	Furnace	Ash	GS
144/A	OCDD	340 ppb	Furnace	Ash	GS
144/A	H7CDF	25 ppb	Furnace	Ash	GS
144/A	OCDF	50 ppb	Furnace	Ash	GS
144/A	TCDD	N/A	Stack	FA	N/A
144/A	P5CDD	80 ppb	Stack	FA	N/A
144/A	H6CDD	180 ppb	Stack	FA	N/A
144/A	H7CDD	290 ppb	Stack	FA	N/A
144/A	OCDD	510 ppb	Stack	FA	N/A
144/A	H7CDF	110 ppb	Stack	FA	N/A
144/A	OCDF	60 ppb	Stack	FA	N/A
144/B	TCDD	ND	ESP	FA	GS
144/B	P5CDD	ND	ESP	FA	GS
144/B	H6CDD	ND	ESP	FA	GS
144/B	H7CDD	30 ppb	ESP	FA	GS
144/B	OCDD	40 ppb	ESP	FA	GS
144/B	H7CDF	ND	ESP	FA	GS
144/B	OCDF	ND	ESP	FA	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
144/B	TCDD	ND	Furnace	Sludge	GS
144/B	P5CDD	ND	Furnace	Sludge	GS
144/B	H6CDD	ND	Furnace	Sludge	GS
144/B	H7CDD	10 ppb	Furnace	Sludge	GS
144/B	OCDD	15 ppb	Furnace	Sludge	GS
144/B	H7CDF	ND	Furnace	Sludge	GS
144/B	OCDF	ND	Furnace	Sludge	GS
144/C	TCDD	ND	Furnace	Sludge	GS
144/C	P5CDD	ND	Furnace	Sludge	GS
144/C	H6CDD	ND	Furnace	Sludge	GS
144/C	H7CDD	6 ppb	Furnace	Sludge	GS
144/C	OCDD	12 ppb	Furnace	Sludge	GS
144/C	H7CDF	ND	Furnace	Sludge	GS
144/C	OCDF	ND	Furnace	Sludge	GS
144/D	TCDD	ND	Stack	FA	N/A
144/D	P5CDD	ND	Stack	FA	N/A
144/D	H6CDD	ND	Stack	FA	N/A
144/D	H7CDD	5 ppb	Stack	FA	N/A
144/D	OCDD	5 ppb	Stack	FA	N/A
144/D	H7CDF	ND	Stack	FA	N/A
144/D	OCDF	ND	Stack	FA	N/A
144/D	TCDD	ND	Furnace	Sludge	GS
144/D	P5CDD	ND	Furnace	Sludge	GS
144/D	H6CDD	ND	Furnace	Sludge	GS
144/D	H7CDD	1 ppb	Furnace	Sludge	GS
144/D	OCDD	1 ppb	Furnace	Sludge	GS
144/D	H7CDF	ND	Furnace	Sludge	GS
144/D	OCDF	ND	Furnace	Sludge	GS
160/1	TCDD	160 ng/dscm	STACK	FG	MM5T
160/1	P5CDD	1100 ng/dscm	STACK	FG	MM5T
160/1	H6CDD	730 ng/dscm	STACK	FG	MM5T
160/1	H7CDD	270 ng/dscm	STACK	FG	MM5T
160/1	OCDD	93 ng/dscm	STACK	FG	MM5T
160/1	TCDF	800 ng/dscm	STACK	FG	MM5T
160/1	P5CDF	2800 ng/dscm	STACK	FG	MM5T
160/1	H6CDF	210 ng/dscm	STACK	FG	MM5T
160/1	H7CDF	210 ng/dscm	STACK	FG	MM5T
160/1	OCDF	8 ng/dscm	STACK	FG	MM5T

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
160/2	TCDD	42 ng/dscm	STACK	FG	MM5T
160/2	P5CDD	270 ng/dscm	STACK	FG	MM5T
160/2	H6CDD	250 ng/dscm	STACK	FG	MM5T
160/2	H7CDD	91 ng/dscm	STACK	FG	MM5T
160/2	OCDD	21 ng/dscm	STACK	FG	MM5T
160/2	TCDF	480 ng/dscm	STACK	FG	MM5T
160/2	P5CDF	1300 ng/dscm	STACK	FG	MM5T
160/2	H6CDF	170 ng/dscm	STACK	FG	MM5T
160/2	H7CDF	100 ng/dscm	STACK	FG	MM5T
160/2	OCDF	8.8 ng/dscm	STACK	FG	MM5T
160/3	TCDD	450 ng/dscm	STACK	FG	MM5T
160/3	P5CDD	2800 ng/dscm	STACK	FG	MM5T
160/3	H6CDD	800 ng/dscm	STACK	FG	MM5T
160/3	H7CDD	210 ng/dscm	STACK	FG	MM5T
160/3	OCDD	36 ng/dscm	STACK	FG	MM5T
160/3	TCDF	2000 ng/dscm	STACK	FG	MM5T
160/3	P5CDF	15000 ng/dscm	STACK	FG	MM5T
160/3	H6CDF	1800 ng/dscm	STACK	FG	MM5T
160/3	H7CDF	380 ng/dscm	STACK	FG	MM5T
160/3	OCDF	24 ng/dscm	STACK	FG	MM5T
160/4	TCDD	370 ng/dscm	STACK	FG	MM5T
160/4	P5CDD	1500 ng/dscm	STACK	FG	MM5T
160/4	H6CDD	590 ng/dscm	STACK	FG	MM5T
160/4	H7CDD	170 ng/dscm	STACK	FG	MM5T
160/4	OCDD	39 ng/dscm	STACK	FG	MM5T
160/4	TCDF	1600 ng/dscm	STACK	FG	MM5T
160/4	P5CDF	9200 ng/dscm	STACK	FG	MM5T
160/4	H6CDF	950 ng/dscm	STACK	FG	MM5T
160/4	H7CDF	230 ng/dscm	STACK	FG	MM5T
160/4	OCDF	18 ng/dscm	STACK	FG	MM5T
160/5	TCDD	110 ng/dscm	STACK	FG	MM5T
160/5	P5CDD	480 ng/dscm	STACK	FG	MM5T
160/5	H6CDD	160 ng/dscm	STACK	FG	MM5T
160/5	H7CDD	42 ng/dscm	STACK	FG	MM5T
160/5	OCDD	15 ng/dscm	STACK	FG	MM5T
160/5	TCDF	560 ng/dscm	STACK	FG	MM5T
160/5	P5CDF	2900 ng/dscm	STACK	FG	MM5T
160/5	H6CDF	340 ng/dscm	STACK	FG	MM5T
160/5	H7CDF	83 ng/dscm	STACK	FG	MM5T
160/5	OCDF	9.2 ng/dscm	STACK	FG	MM5T

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
160	TCDD	0.32 ng/g	DUST CO.	BOTTOM ASH	GS
160	P5CDD	ND	DUST CO.	BOTTOM ASH	GS
160	H6CDD	ND	DUST CO.	BOTTOM ASH	GS
160	H7CDD	ND	DUST CO.	BOTTOM ASH	GS
160	OCDD	ND	DUST CO.	BOTTOM ASH	GS
160	TCDF	1.4 ng/g	DUST CO.	BOTTOM ASH	GS
160	P5CDF	6.2 ng/g	DUST CO.	BOTTOM ASH	GS
160	H6CDF	ND	DUST CO.	BOTTOM ASH	GS
160	H7CDF	ND	DUST CO.	BOTTOM ASH	GS
160	OCDF	ND	DUST CO.	BOTTOM ASH	GS
160	TCDD	170 ng/g	DUST CO.	FA	GS
160	P5CDD	530 ng/g	DUST CO.	FA	GS
160	H6CDD	52 ng/g	DUST CO.	FA	GS
160	H7CDD	7.4 ng/g	DUST CO.	FA	GS
160	OCDD	2.6 ng/g	DUST CO.	FA	GS
160	TCDF	410 ng/g	DUST CO.	FA	GS
160	P5CDF	1800 ng/g	DUST CO.	FA	GS
160	H6CDF	83 ng/g	DUST CO.	FA	GS
160	H7CDF	9.5 ng/g	DUST CO.	FA	GS
160	OCDF	1.4 ng/g	DUST CO.	FA	GS
168/NW1:4A	2378-TCDD	5.4 ng/nm3	STACK	FG	MM5T
168/NW1:4A	TCDD	190 ng/nm3	STACK	FG	MM5T
168/NW1:4A	P5CDD	610 ng/nm3	STACK	FG	MM5T
168/NW1:4A	H6CDD	310 ng/nm3	STACK	FG	MM5T
168/NW1:4A	H7CDD	120 ng/nm3	STACK	FG	MM5T
168/NW1:4A	OCDD	61 ng/nm3	STACK	FG	MM5T
168/NW1:4A	TOTAL	1300 ng/nm3	STACK	FG	MM5T
168/NW1:4A	2378-TCDF	27 ng/nm3	STACK	FG	MM5T
168/NW1:4A	TCDF	540 ng/nm3	STACK	FG	MM5T
168/NW1:4A	P5CDF	650 ng/nm3	STACK	FG	MM5T
168/NW1:4A	H6CDF	310 ng/nm3	STACK	FG	MM5T
168/NW1:4A	H7CDF	100 ng/nm3	STACK	FG	MM5T
168/NW1:4A	OCDF	10 ng/nm3	STACK	FG	MM5T
168/NW1:4A	TOTAL	1600 ng/nm3	STACK	FG	MM5T

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
168/NW1:5A	2378-TCDD	4.4 ng/nm3	STACK	FG	MM5T
168/NW1:5A	TCDD	110 ng/nm3	STACK	FG	MM5T
168/NW1:5A	P5CDD	440 ng/nm3	STACK	FG	MM5T
168/NW1:5A	H6CDD	350 ng/nm3	STACK	FG	MM5T
168/NW1:5A	H7CDD	150 ng/nm3	STACK	FG	MM5T
168/NW1:5A	OCDD	52 ng/nm3	STACK	FG	MM5T
168/NW1:5A	TOTAL	1100 ng/nm3	STACK	FG	MM5T
168/NW1:5A	2378-TCDF	14 ng/nm3	STACK	FG	MM5T
168/NW1:5A	TCDF	140 ng/nm3	STACK	FG	MM5T
168/NW1:5A	P5CDF	402 ng/nm3	STACK	FG	MM5T
168/NW1:5A	H6CDF	320 ng/nm3	STACK	FG	MM5T
168/NW1:5A	H7CDF	120 ng/nm3	STACK	FG	MM5T
168/NW1:5A	OCDF	10 ng/nm3	STACK	FG	MM5T
168/NW1:5A	TOTAL	1000 ng/nm3	STACK	FG	MM5T
168/NW1:6A	2378-TCDD	8.3 ng/nm3	STACK	FG	MM5T
168/NW1:6A	TCDD	160 ng/nm3	STACK	FG	MM5T
168/NW1:6A	P5CDD	360 ng/nm3	STACK	FG	MM5T
168/NW1:6A	H6CDD	3000 ng/nm3	STACK	FG	MM5T
168/NW1:6A	H7CDD	930 ng/nm3	STACK	FG	MM5T
168/NW1:6A	OCDD	270 ng/nm3	STACK	FG	MM5T
168/NW1:6A	TOTAL	4700 ng/nm3	STACK	FG	MM5T
168/NW1:6A	2378-TCDF	35 ng/nm3	STACK	FG	MM5T
168/NW1:6A	TCDF	550 ng/nm3	STACK	FG	MM5T
168/NW1:6A	P5CDF	550 ng/nm3	STACK	FG	MM5T
168/NW1:6A	H6CDF	3100 ng/nm3	STACK	FG	MM5T
168/NW1:6A	H7CDF	750 ng/nm3	STACK	FG	MM5T
168/NW1:6A	OCDF	43 ng/nm3	STACK	FG	MM5T
168/NW1:6A	TOTAL	5000 ng/nm3	STACK	FG	MM5T
168/NW2:1A	2378-TCDD	12 ng/nm3	STACK	FG	MM5T
168/NW2:1A	TCDD	110 ng/nm3	STACK	FG	MM5T
168/NW2:1A	P5CDD	260 ng/nm3	STACK	FG	MM5T
168/NW2:1A	H6CDD	83 ng/nm3	STACK	FG	MM5T
168/NW2:1A	H7CDD	30 ng/nm3	STACK	FG	MM5T
168/NW2:1A	OCDD	11 ng/nm3	STACK	FG	MM5T
168/NW2:1A	TOTAL	490 ng/nm3	STACK	FG	MM5T
168/NW2:1A	2378-TCDF	8.7 ng/nm3	STACK	FG	MM5T
168/NW2:1A	TCDF	170 ng/nm3	STACK	FG	MM5T
168/NW2:1A	P5CDF	250 ng/nm3	STACK	FG	MM5T
168/NW2:1A	H6CDF	83 ng/nm3	STACK	FG	MM5T
168/NW2:1A	H7CDF	27 ng/nm3	STACK	FG	MM5T
168/NW2:1A	OCDF	2.6 ng/nm3	STACK	FG	MM5T
168/NW2:1A	TOTAL	550 ng/nm3	STACK	FG	MM5T

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
168/NW2:2A	2378-TCDD	6.8 ng/nm3	STACK	FG	MM5T
168/NW2:2A	TCDD	220 ng/nm3	STACK	FG	MM5T
168/NW2:2A	P5CDD	610 ng/nm3	STACK	FG	MM5T
168/NW2:2A	H6CDD	-----	STACK	FG	MM5T
168/NW2:2A	H7CDD	-----	STACK	FG	MM5T
168/NW2:2A	OCDD	-----	STACK	FG	MM5T
168/NW2:2A	TOTAL		STACK	FG	MM5T
168/NW2:2A	2378-TCDF	18 ng/nm3	STACK	FG	MM5T
168/NW2:2A	TCDF	430 ng/nm3	STACK	FG	MM5T
168/NW2:2A	P5CDF	470 ng/nm3	STACK	FG	MM5T
168/NW2:2A	H6CDF	-----	STACK	FG	MM5T
168/NW2:2A	H7CDF	-----	STACK	FG	MM5T
168/NW2:2A	OCDF	-----	STACK	FG	MM5T
168/NW2:2A	TOTAL		STACK	FG	MM5T
168/NW2:3B	2378-TCDD	4.3 ng/nm3	STACK	FG	MM5T
168/NW2:3B	TCDD	100 ng/nm3	STACK	FG	MM5T
168/NW2:3B	P5CDD	350 ng/nm3	STACK	FG	MM5T
168/NW2:3B	H6CDD	340 ng/nm3	STACK	FG	MM5T
168/NW2:3B	H7CDD	170 ng/nm3	STACK	FG	MM5T
168/NW2:3B	OCDD	74 ng/nm3	STACK	FG	MM5T
168/NW2:3B	TOTAL	1000 ng/nm3	STACK	FG	MM5T
168/NW2:3B	2378-TCDF	14 ng/nm3	STACK	FG	MM5T
168/NW2:3B	TCDF	272 ng/nm3	STACK	FG	MM5T
168/NW2:3B	P5CDF	390 ng/nm3	STACK	FG	MM5T
168/NW2:3B	H6CDF	280 ng/nm3	STACK	FG	MM5T
168/NW2:3B	H7CDF	86 ng/nm3	STACK	FG	MM5T
168/NW2:3B	OCDF	11 ng/nm3	STACK	FG	MM5T
168/NW2:3B	TOTAL	1000 ng/nm3	STACK	FG	MM5T
168/NW1/4AB	2378-TCDD	6.6 ng/g	ESP	FA	GS
168/NW1/4AB	TCDD	340 ng/g	ESP	FA	GS
168/NW1/4AB	P5CDD	640 ng/g	ESP	FA	GS
168/NW1/4AB	H6CDD	660 ng/g	ESP	FA	GS
168/NW1/4AB	H7CDD	170 ng/g	ESP	FA	GS
168/NW1/4AB	OCDD	42 ng/g	ESP	FA	GS
168/NW1/4AB	TOTAL	1900 ng/g	ESP	FA	GS
168/NW1/4AB	2378-TCDF	13 ng/g	ESP	FA	GS
168/NW1/4AB	TCDF	330 ng/g	ESP	FA	GS
168/NW1/4AB	P5CDF	370 ng/g	ESP	FA	GS
168/NW1/4AB	H6CDF	500 ng/g	ESP	FA	GS
168/NW1/4AB	H7CDF	110 ng/g	ESP	FA	GS
168/NW1/4AB	OCDF	6.2 ng/g	ESP	FA	GS
168/NW1/4AB	TOTAL	1300 ng/g	ESP	FA	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
168/NW1/5:1	2378-TCDD	5.9 ng/g	ESP	FA	GS
168/NW1/5:1	TCDD	330 ng/g	ESP	FA	GS
168/NW1/5:1	P5CDD	730 ng/g	ESP	FA	GS
168/NW1/5:1	H6CDD	1000 ng/g	ESP	FA	GS
168/NW1/5:1	H7CDD	240 ng/g	ESP	FA	GS
168/NW1/5:1	OCDD	49 ng/g	ESP	FA	GS
168/NW1/5:1	TOTAL	2300 ng/g	ESP	FA	GS
168/NW1/5:1	2378-TCDF	11 ng/g	ESP	FA	GS
168/NW1/5:1	TCDF	300 ng/g	ESP	FA	GS
168/NW1/5:1	P5CDF	430 ng/g	ESP	FA	GS
168/NW1/5:1	H6CDF	920 ng/g	ESP	FA	GS
168/NW1/5:1	H7CDF	210 ng/g	ESP	FA	GS
168/NW1/5:1	OCDF	11 ng/g	ESP	FA	GS
168/NW1/5:1	TOTAL	1900 ng/g	ESP	FA	GS
168/NW1/5:2	2378-TCDD	6.4 ng/g	ESP	FA	GS
168/NW1/5:2	TCDD	410 ng/g	ESP	FA	GS
168/NW1/5:2	P5CDD	800 ng/g	ESP	FA	GS
168/NW1/5:2	H6CDD	510 ng/g	ESP	FA	GS
168/NW1/5:2	H7CDD	120 ng/g	ESP	FA	GS
168/NW1/5:2	OCDD	28 ng/g	ESP	FA	GS
168/NW1/5:2	TOTAL	1900 ng/g	ESP	FA	GS
168/NW1/5:2	2378-TCDF	11 ng/g	ESP	FA	GS
168/NW1/5:2	TCDF	350 ng/g	ESP	FA	GS
168/NW1/5:2	P5CDF	520 ng/g	ESP	FA	GS
168/NW1/5:2	H6CDF	570 ng/g	ESP	FA	GS
168/NW1/5:2	H7CDF	110 ng/g	ESP	FA	GS
168/NW1/5:2	OCDF	6.8 ng/g	ESP	FA	GS
168/NW1/5:2	TOTAL	1200 ng/g	ESP	FA	GS
168/NW1/6AB	2378-TCDD	3.9 ng/g	ESP	FA	GS
168/NW1/6AB	TCDD	290 ng/g	ESP	FA	GS
168/NW1/6AB	P5CDD	450 ng/g	ESP	FA	GS
168/NW1/6AB	H6CDD	750 ng/g	ESP	FA	GS
168/NW1/6AB	H7CDD	290 ng/g	ESP	FA	GS
168/NW1/6AB	OCDD	49 ng/g	ESP	FA	GS
168/NW1/6AB	TOTAL	1800 ng/g	ESP	FA	GS
168/NW1/6AB	2378-TCDF	6.8 ng/g	ESP	FA	GS
168/NW1/6AB	TCDF	210 ng/g	ESP	FA	GS
168/NW1/6AB	P5CDF	270 ng/g	ESP	FA	GS
168/NW1/6AB	H6CDF	900 ng/g	ESP	FA	GS
168/NW1/6AB	H7CDF	170 ng/g	ESP	FA	GS
168/NW1/6AB	OCDF	7.7 ng/g	ESP	FA	GS
168/NW1/6AB	TOTAL	1600 ng/g	ESP	FA	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
168/NW2/1:1	2378-TCDD	6.0 ng/g	ESP	FA	GS
168/NW2/1:1	TCDD	270 ng/g	ESP	FA	GS
168/NW2/1:1	P5CDD	660 ng/g	ESP	FA	GS
168/NW2/1:1	H6CDD	350 ng/g	ESP	FA	GS
168/NW2/1:1	H7CDD	110 ng/g	ESP	FA	GS
168/NW2/1:1	OCDD	31 ng/g	ESP	FA	GS
168/NW2/1:1	TOTAL	1400 ng/g	ESP	FA	GS
168/NW2/1:1	2378-TCDF	0.11 ng/g	ESP	FA	GS
168/NW2/1:1	TCDF	280 ng/g	ESP	FA	GS
168/NW2/1:1	P5CDF	410 ng/g	ESP	FA	GS
168/NW2/1:1	H6CDF	350 ng/g	ESP	FA	GS
168/NW2/1:1	H7CDF	100 ng/g	ESP	FA	GS
168/NW2/1:1	OCDF	6.2 ng/g	ESP	FA	GS
168/NW2/1:1	TOTAL	1100 ng/g	ESP	FA	GS
168/NW2/1:2A	2378-TCDD	4.0 ng/g	ESP	FA	GS
168/NW2/1:2A	TCDD	160 ng/g	ESP	FA	GS
168/NW2/1:2A	P5CDD	330 ng/g	ESP	FA	GS
168/NW2/1:2A	H6CDD	790 ng/g	ESP	FA	GS
168/NW2/1:2A	H7CDD	230 ng/g	ESP	FA	GS
168/NW2/1:2A	OCDD	55 ng/g	ESP	FA	GS
168/NW2/1:2A	TOTAL	1600 ng/g	ESP	FA	GS
168/NW2/1:2A	2378-TCDF	7.11 ng/g	ESP	FA	GS
168/NW2/1:2A	TCDF	170 ng/g	ESP	FA	GS
168/NW2/1:2A	P5CDF	240 ng/g	ESP	FA	GS
168/NW2/1:2A	H6CDF	640 ng/g	ESP	FA	GS
168/NW2/1:2A	H7CDF	150 ng/g	ESP	FA	GS
168/NW2/1:2A	OCDF	8.6 ng/g	ESP	FA	GS
168/NW2/1:2A	TOTAL	1200 ng/g	ESP	FA	GS
168/NW2/1:2B	2378-TCDD	4.9 ng/g	ESP	FA	GS
168/NW2/1:2B	TCDD	230 ng/g	ESP	FA	GS
168/NW2/1:2B	P5CDD	450 ng/g	ESP	FA	GS
168/NW2/1:2B	H6CDD	-	ESP	FA	GS
168/NW2/1:2B	H7CDD	-	ESP	FA	GS
168/NW2/1:2B	OCDD	-	ESP	FA	GS
168/NW2/1:2B	TOTAL	-	ESP	FA	GS
168/NW2/1:2B	2378-TCDF	8.1 ng/g	ESP	FA	GS
168/NW2/1:2B	TCDF	200 ng/g	ESP	FA	GS
168/NW2/1:2B	P5CDF	220 ng/g	ESP	FA	GS
168/NW2/1:2B	H6CDF	-	ESP	FA	GS
168/NW2/1:2B	H7CDF	-	ESP	FA	GS
168/NW2/1:2B	OCDF	-	ESP	FA	GS
168/NW2/1:2B	TOTAL	-	ESP	FA	GS
168/NW2/2AB	2378-TCDD	3.7 ng/g	ESP	FA	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
168/NW2/2AB	TCDD	160 ng/g	ESP	FA	GS
168/NW2/2AB	P5CDD	380 ng/g	ESP	FA	GS
168/NW2/2AB	H6CDD	390 ng/g	ESP	FA	GS
168/NW2/2AB	H7CDD	95 ng/g	ESP	FA	GS
168/NW2/2AB	OCDD	20 ng/g	ESP	FA	GS
168/NW2/2AB	TOTAL	1000 ng/g	ESP	FA	GS
168/NW2/2AB	2378-TCDF	6.3 ng/g	ESP	FA	GS
168/NW2/2AB	TCDF	170 ng/g	ESP	FA	GS
168/NW2/2AB	P5CDF	260 ng/g	ESP	FA	GS
168/NW2/2AB	H6CDF	390 ng/g	ESP	FA	GS
168/NW2/2AB	H7CDF	72 ng/g	ESP	FA	GS
168/NW2/2AB	OCDF	1.8 ng/g	ESP	FA	GS
168/NW2/2AB	TOTAL	900 ng/g	ESP	FA	GS
168/NW2/3AB	2378-TCDD	-	ESP	FA	GS
168/NW2/3AB	TCDD	-	ESP	FA	GS
168/NW2/3AB	P5CDD	-	ESP	FA	GS
168/NW2/3AB	H6CDD	420 ng/g	ESP	FA	GS
168/NW2/3AB	H7CDD	100 ng/g	ESP	FA	GS
168/NW2/3AB	OCDD	24 ng/g	ESP	FA	GS
168/NW2/3AB	TOTAL	-	ESP	FA	GS
168/NW2/3AB	2378-TCDF	-	ESP	FA	GS
168/NW2/3AB	TCDF	-	ESP	FA	GS
168/NW2/3AB	P5CDF	-	ESP	FA	GS
168/NW2/3AB	H6CDF	490 ng/g	ESP	FA	GS
168/NW2/3AB	H7CDF	110 ng/g	ESP	FA	GS
168/NW2/3AB	OCDF	5.3 ng/g	ESP	FA	GS
168/NW2/3AB	TOTAL	-	ESP	FA	GS
168/EC1/7:1	2378-TCDD	3.5 ng/g	ESP	FA	GS
168/EC1/7:1	TCDD	210 ng/g	ESP	FA	GS
168/EC1/7:1	P5CDD	730 ng/g	ESP	FA	GS
168/EC1/7:1	H6CDD	530 ng/g	ESP	FA	GS
168/EC1/7:1	H7CDD	270 ng/g	ESP	FA	GS
168/EC1/7:1	OCDD	170 ng/g	ESP	FA	GS
168/EC1/7:1	TOTAL	1900 ng/g	ESP	FA	GS
168/EC1/7:1	2378-TCDF	6.4 ng/g	ESP	FA	GS
168/EC1/7:1	TCDF	180 ng/g	ESP	FA	GS
168/EC1/7:1	P5CDF	270 ng/g	ESP	FA	GS
168/EC1/7:1	H6CDF	330 ng/g	ESP	FA	GS
168/EC1/7:1	H7CDF	160 ng/g	ESP	FA	GS
168/EC1/7:1	OCDF	24 ng/g	ESP	FA	GS
168/EC1/7:1	TOTAL	960 ng/g	ESP	FA	GS
168/EC1/7:2	2378-TCDD	-----	ESP	FA	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
168/EC1/7:2	TCDD	-----	ESP	FA	GS
168/EC1/7:2	P5CDD	-----	ESP	FA	GS
168/EC1/7:2	H6CDD	680 ng/g	ESP	FA	GS
168/EC1/7:2	H7CDD	270 ng/g	ESP	FA	GS
168/EC1/7:2	OCDD	140 ng/g	ESP	FA	GS
168/EC1/7:2	TOTAL		ESP	FA	GS
168/EC1/7:2	2378-TCDF	-----	ESP	FA	GS
168/EC1/7:2	TCDF	-----	ESP	FA	GS
168/EC1/7:2	P5CDF	-----	ESP	FA	GS
168/EC1/7:2	H6CDF	350 ng/g	ESP	FA	GS
168/EC1/7:2	H7CDF	150 ng/g	ESP	FA	GS
168/EC1/7:2	OCDF	19 ng/g	ESP	FA	GS
168/EC1/7:2	TOTAL		ESP	FA	GS
168/EC2/8:1	2378-TCDD	.60 ng/g	ESP	FA	GS
168/EC2/8:1	TCDD	46 ng/g	ESP	FA	GS
168/EC2/8:1	P5CDD	230 ng/g	ESP	FA	GS
168/EC2/8:1	H6CDD	150 ng/g	ESP	FA	GS
168/EC2/8:1	H7CDD	133 ng/g	ESP	FA	GS
168/EC2/8:1	OCDD	190 ng/g	ESP	FA	GS
168/EC2/8:1	TOTAL	750 ng/g	ESP	FA	GS
168/EC2/8:1	2378-TCDF	1.4 ng/g	ESP	FA	GS
168/EC2/8:1	TCDF	34 ng/g	ESP	FA	GS
168/EC2/8:1	P5CDF	64 ng/g	ESP	FA	GS
168/EC2/8:1	H6CDF	71 ng/g	ESP	FA	GS
168/EC2/8:1	H7CDF	76 ng/g	ESP	FA	GS
168/EC2/8:1	OCDF	23 ng/g	ESP	FA	GS
168/EC2/8:1	TOTAL	270 ng/g	ESP	FA	GS
168/EC2/8:2	2378-TCDD	.62 ng/g	ESP	FA	GS
168/EC2/8:2	TCDD	44 ng/g	ESP	FA	GS
168/EC2/8:2	P5CDD	210 ng/g	ESP	FA	GS
168/EC2/8:2	H6CDD	170 ng/g	ESP	FA	GS
168/EC2/8:2	H7CDD	140 ng/g	ESP	FA	GS
168/EC2/8:2	OCDD	190 ng/g	ESP	FA	GS
168/EC2/8:2	TOTAL	750 ng/g	ESP	FA	GS
168/EC2/8:2	2378-TCDF	1.5 ng/g	ESP	FA	GS
168/EC2/8:2	TCDF	39 ng/g	ESP	FA	GS
168/EC2/8:2	P5CDF	81 ng/g	ESP	FA	GS
168/EC2/8:2	H6CDF	73 ng/g	ESP	FA	GS
168/EC2/8:2	H7CDF	98 ng/g	ESP	FA	GS
168/EC2/8:2	OCDF	23 ng/g	ESP	FA	GS
168/EC2/8:2	TOTAL	310 ng/g	ESP	FA	GS
168/EC2/8:3A	2378-TCDD	.48 ng/g	ESP	FA	GS
168/EC2/8:3A	TCDD	35 ng/g	ESP	FA	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
168/EC2/8:3A	P5CDD	140 ng/g	ESP	FA	GS
168/EC2/8:3A	H6CDD	140 ng/g	ESP	FA	GS
168/EC2/8:3A	H7CDD	150 ng/g	ESP	FA	GS
168/EC2/8:3A	OCDD	180 ng/g	ESP	FA	GS
168/EC2/8:3A	TOTAL	650 ng/g	ESP	FA	GS
168/EC2/8:3A	2378-TCDF	1.2 ng/g	ESP	FA	GS
168/EC2/8:3A	TCDF	28 ng/g	ESP	FA	GS
168/EC2/8:3A	P5CDF	46 ng/g	ESP	FA	GS
168/EC2/8:3A	H6CDF	62 ng/g	ESP	FA	GS
168/EC2/8:3A	H7CDF	62 ng/g	ESP	FA	GS
168/EC2/8:3A	OCDF	20 ng/g	ESP	FA	GS
168/EC2/8:3A	TOTAL	220 ng/g	ESP	FA	GS
168/EC2/8:3B	2378-TCDD	.56 ng/g	ESP	FA	GS
168/EC2/8:3B	TCDD	44 ng/g	ESP	FA	GS
168/EC2/8:3B	P5CDD	160 ng/g	ESP	FA	GS
168/EC2/8:3B	H6CDD	-----	ESP	FA	GS
168/EC2/8:3B	H7CDD	-----	ESP	FA	GS
168/EC2/8:3B	OCDD	-----	ESP	FA	GS
168/EC2/8:3B	TOTAL	-----	ESP	FA	GS
168/EC2/8:3B	2378-TCDF	1.4 ng/g	ESP	FA	GS
168/EC2/8:3B	TCDF	31 ng/g	ESP	FA	GS
168/EC2/8:3B	P5CDF	54 ng/g	ESP	FA	GS
168/EC2/8:3B	H6CDF	-----	ESP	FA	GS
168/EC2/8:3B	H7CDF	-----	ESP	FA	GS
168/EC2/8:3B	OCDF	-----	ESP	FA	GS
168/EC2/8:3B	TOTAL	-----	ESP	FA	GS
168/EC1/7:1	2378-TCDD	.56 ng/g	BOTTOM	ASH	GS
168/EC1/7:1	TCDD	6.7 ng/g	BOTTOM	ASH	GS
168/EC1/7:1	P5CDD	16 ng/g	BOTTOM	ASH	GS
168/EC1/7:1	H6CDD	18 ng/g	BOTTOM	ASH	GS
168/EC1/7:1	H7CDD	10 ng/g	BOTTOM	ASH	GS
168/EC1/7:1	OCDD	13 ng/g	BOTTOM	ASH	GS
168/EC1/7:1	TOTAL	64 ng/g	BOTTOM	ASH	GS
168/EC1/7:1	2378-TCDF	.25 ng/g	BOTTOM	ASH	GS
168/EC1/7:1	TCDF	5.0 ng/g	BOTTOM	ASH	GS
168/EC1/7:1	P5CDF	7.1 ng/g	BOTTOM	ASH	GS
168/EC1/7:1	H6CDF	10 ng/g	BOTTOM	ASH	GS
168/EC1/7:1	H7CDF	6.0 ng/g	BOTTOM	ASH	GS
168/EC1/7:1	OCDF	1.7 ng/g	BOTTOM	ASH	GS
168/EC1/7:1	TOTAL	30 ng/g	BOTTOM	ASH	GS
168/EC1/7:2	2378-TCDD	.17 ng/g	BOTTOM	ASH	GS
168/EC1/7:[illegible]	TCDD	7.1 ng/g	BOTTOM	ASH	GS
168/EC1/7:2	P5CDD	23 ng/g	BOTTOM	ASH	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
168/EC1/7:2	H6CDD	-----	BOTTOM	ASH	GS
168/EC1/7:2	H7CDD	-----	BOTTOM	ASH	GS
168/EC1/7:2	OCDD	-----	BOTTOM	ASH	GS
168/EC1/7:2	TOTAL		BOTTOM	ASH	GS
168/EC1/7:2	2378-TCDF	.32 ng/g	BOTTOM	ASH	GS
168/EC1/7:2	TCDF	7.6 ng/g	BOTTOM	ASH	GS
168/EC1/7:2	P5CDF	11 ng/g	BOTTOM	ASH	GS
168/EC1/7:2	H6CDF	-----	BOTTOM	ASH	GS
168/EC1/7:2	H7CDF	-----	BOTTOM	ASH	GS
168/EC1/7:2	OCDF	-----	BOTTOM	ASH	GS
168/EC1/7:2	TOTAL		BOTTOM	ASH	GS
168/EC2/8:1	2378-TCDD	[illegible]	BOTTOM	ASH	GS
168/EC2/8:1	TCDD	.14 ng/g	BOTTOM	ASH	GS
168/EC2/8:1	P5CDD	.67 ng/g	BOTTOM	ASH	GS
168/EC2/8:1	H6CDD	-----	BOTTOM	ASH	GS
168/EC2/8:1	H7CDD	-----	BOTTOM	ASH	GS
168/EC2/8:1	OCDD	-----	BOTTOM	ASH	GS
168/EC2/8:1	TOTAL		BOTTOM	ASH	GS
168/EC2/8:1	2378-TCDF	.041 ng/g	BOTTOM	ASH	GS
168/EC2/8:1	TCDF	.55 ng/g	BOTTOM	ASH	GS
168/EC2/8:1	P5CDF	.24 ng/g	BOTTOM	ASH	GS
168/EC2/8:1	H6CDF	-----	BOTTOM	ASH	GS
168/EC2/8:1	H7CDF	-----	BOTTOM	ASH	GS
168/EC2/8:1	OCDF	-----	BOTTOM	ASH	GS
168/EC2/8:1	TOTAL		BOTTOM	ASH	GS
168/EC2/8:2	2378-TCDD	.016 ng/g	BOTTOM	ASH	GS
168/EC2/8:2	TCDD	.20 ng/g	BOTTOM	ASH	GS
168/EC2/8:2	P5CDD	1.2 ng/g	BOTTOM	ASH	GS
168/EC2/8:2	H6CDD	-----	BOTTOM	ASH	GS
168/EC2/8:2	H7CDD	-----	BOTTOM	ASH	GS
168/EC2/8:2	OCDD	-----	BOTTOM	ASH	GS
168/EC2/8:2	TOTAL		BOTTOM	ASH	GS
168/EC2/8:2	2378-TCDF	.029 ng/g	BOTTOM	ASH	GS
168/EC2/8:2	TCDF	.70 ng/g	BOTTOM	ASH	GS
168/EC2/8:2	P5CDF	.82 ng/g	BOTTOM	ASH	GS
168/EC2/8:2	H6CDF	-----	BOTTOM	ASH	GS
168/EC2/8:2	H7CDF	-----	BOTTOM	ASH	GS
168/EC2/8:2	OCDF	-----	BOTTOM	ASH	GS
168/EC2/8:2	TOTAL		BOTTOM	ASH	GS
168/EC2/8:3	2378-TCDD	.031 ng/g	BOTTOM	ASH	GS
168/EC2/8:3	TCDD	.16 ng/g	BOTTOM	ASH	GS
168/EC2/8:3	P5CDD	.70 ng/g	BOTTOM	ASH	GS
168/EC2/8:3	H6CDD	-----	BOTTOM	ASH	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
168/EC2/8:3	H7CDD	-----	BOTTOM	ASH	GS
168/EC2/8:3	OCDD	-----	BOTTOM	ASH	GS
168/EC2/8:3	TOTAL		BOTTOM	ASH	GS
168/EC2/8:3	2378-TCDF	.041 ng/g	BOTTOM	ASH	GS
168/EC2/8:3	TCDF	.38 ng/g	BOTTOM	ASH	GS
168/EC2/8:3	P5CDF	.76 ng/g	BOTTOM	ASH	GS
168/EC2/8:3	H6CDF	-----	BOTTOM	ASH	GS
168/EC2/8:3	H7CDF	-----	BOTTOM	ASH	GS
168/EC2/8:3	OCDF	-----	BOTTOM	ASH	GS
168/EC2/8:3	TOTAL		BOTTOM	ASH	GS
174/A	TCDD	538 ng/m3	Stack	FG	MM5T
174/A	P5CDD	727 ng/m3	Stack	FG	MM5T
174/A	H6CDD	1197 ng/m3	Stack	FG	MM5T
174/A	H7CDD	[illegible] ng/m3	Stack	FG	MM5T
174/A	OCDD	346 ng/m3	Stack	FG	MM5T
174/A	TCDF	3419 ng/m3	Stack	FG	MM5T
174/A	P5CDF	1385 ng/m3	Stack	FG	MM5T
174/A	H6CDF	1583 ng/m3	Stack	FG	MM5T
174/A	H7CDF	1395 ng/m3	Stack	FG	MM5T
174/A	OCDF	151 ng/m3	Stack	FG	MM5T
174/B	TCDD	2.25 ng/m3	Stack	FG	MM5T
174/B	P5CDD	1.7 ng/m3	Stack	FG	MM5T
174/B	H6CDD	3.4 ng/m3	Stack	FG	MM5T
174/B	H7CDD	26.2 ng/m3	Stack	FG	MM5T
174/B	OCDD	14.2 ng/m3	Stack	FG	MM5T
174/B	TCDF	20.7 ng/m3	Stack	FG	MM5T
174/B	P5CDF	8.8 ng/m3	Stack	FG	MM5T
174/B	H6CDF	14.9 ng/m3	Stack	FG	MM5T
174/B	H7CDF	58.2 ng/m3			
174/B	OCDF	7.3 ng/m3			
178/Alk	TCDD	113.8 ppb	ESP	FA	GS
178/Alk	H6CDD	435.2 ppb	ESP	FA	GS
178/Alk	OCDD	96.4 ppb	ESP	FA	GS
178/Alk	TCDF	220.1 ppb	ESP	FA	GS
178/Alk	H6CDF	421.2 ppb	ESP	FA	GS
178/Alk	OCDF	18 ppb	ESP	FA	GS
178/Ams	TCDD	14.1 ppb	ESP	FA	GS
178/Ams	H6CDD	152.2 ppb	ESP	FA	GS
178/Ams	OCDD	401 ppb	ESP	FA	GS
178/Ams	TCDF	61.5 ppb	ESP	FA	GS
178/Ams	H6CDF	128.3 ppb	ESP	FA	GS
178/Ams	OCDF	28 ppb	ESP	FA	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
178/Arn	TCDD	24 ppb	ESP	FA	GS
178/Arn	H6CDD	136 ppb	ESP	FA	GS
178/Arn	OCDD	51 ppb	ESP	FA	GS
178/Arn	TCDF	91 ppb	ESP	FA	GS
178/Arn	H6CDF	82 ppb	ESP	FA	GS
178/Arn	OCDF	11 ppb	ESP	FA	GS
178/Lee	TCDD	226 ppb	ESP	FA	GS
178/Lee	H6CDD	560 ppb	ESP	FA	GS
178/Lee	OCDD	110 ppb	ESP	FA	GS
178/Lee	TCDF	240 ppb	ESP	FA	GS
178/Lee	H6CDF	280 ppb	ESP	FA	GS
178/Lee	OCDF	10 ppb	ESP	FA	GS
178/Lei	TCDD	212 ppb	ESP	FA	GS
178/Lei	H6CDD	910 ppb	ESP	FA	GS
178/Lei	OCDD	550 ppb	ESP	FA	GS
178/Lei	TCDF	220 ppb	ESP	FA	GS
178/Lei	H6CDF	530 ppb	ESP	FA	GS
178/Lei	OCDF	110 ppb	ESP	FA	GS
178/Rij	TCDD	ND	ESP	FA	GS
178/Rij	H6CDD	10 ppb	ESP	FA	GS
178/Rij	OCDD	10 ppb	ESP	FA	GS
178/Rij	TCDF	50 ppb	ESP	FA	GS
178/Rij	H6CDF	60 ppb	ESP	FA	GS
178/Rij	OCDF	10 ppb	ESP	FA	GS
178/Roo	TCDD	40 ppb	ESP	FA	GS
178/Roo	H6CDD	330 ppb	ESP	FA	GS
178/Roo	OCDD	190 ppb	ESP	FA	GS
178/Roo	TCDF	110 ppb	ESP	FA	GS
178/Roo	H6CDF	150 ppb	ESP	FA	GS
178/Roo	OCDF	40 ppb	ESP	FA	GS
178/Rot	TCDD	18 ppb	ESP	FA	GS
178/Rot	H6CDD	140 ppb	ESP	FA	GS
178/Rot	OCDD	190 ppb	ESP	FA	GS
178/Rot	TCDF	70 ppb	ESP	FA	GS
178/Rot	H6CDF	70 ppb	ESP	FA	GS
178/Rot	OCDF	20 ppb	ESP	FA	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
178/Zaa	TCDD	57.1 ng/Nm3	Stack	FG	Train
178/Zaa	P5CDD	132.1 ng/Nm3	Stack	FG	Train
178/Zaa	H6CDD	439.8 ng/Nm3	Stack	FG	Train
178/Zaa	H7CDD	177 ng/Nm3	Stack	FG	Train
178/Zaa	OCDD	451.7 ng/Nm3	Stack	FG	Train
178/Zaa	TCDF	161.1 ng/Nm3	Stack	FG	Train
178/Zaa	P5CDF	155.2 ng/Nm3	Stack	FG	Train
178/Zaa	H6CDF	[illegible].4 ng/Nm3	Stack	FG	Train
178/Zaa	H7CDF	204.2 ng/Nm3	Stack	FG	Train
178/Zaa	OCDF	67.6 ng/Nm3	Stack	FG	Train
178/Zaa	TCDD	88.8 ppb	ESP	FA	Cont. S
178/Zaa	P5CDD	433.8 ppb	ESP	FA	Cont. S
178/Zaa	H6CDD	1576.3 ppb	ESP	FA	Cont. S
178/Zaa	H7CDD	1701.5 ppb	ESP	FA	Cont. S
178/Zaa	OCDD	1372.6 ppb	ESP	FA	Cont. S
178/Zaa	TCDF	182.7 ppb	ESP	FA	Cont. S
178/Zaa	P5CDF	399.1 ppb	ESP	FA	Cont. S
178/Zaa	H6CDF	863.1 ppb	ESP	FA	Cont. S
178/Zaa	H7CDF	541.5 ppb	ESP	FA	Cont. S
178/Zaa	OCDF	94.2 ppb	ESP	FA	Cont. S
178/Zaa	TCDD	[illegible]06.5 ppb	ESP	FA	GS
178/Zaa	H6CDD	730.9 ppb	ESP	FA	GS
178/Zaa	OCDD	358.7 ppb	ESP	FA	GS
178/Zaa	TCDF	211 ppb	ESP	FA	GS
178/Zaa	H6CDF	590 ppb	ESP	FA	GS
178/Zaa	OCDF	60.13 ppb	ESP	FA	GS
181	TCDD	760 ng/m3	Stack	FG	MM5T
181	P5CDD	714 ng/m3	Stack	FG	MM5T
181	H6CDD	686 ng/m3	Stack	FG	MM5T
181	H7CDD	298 ng/m3	Stack	FG	MM5T
181	OCDD	229 ng/m3	Stack	FG	MM5T
181	TCDD	3.65 ng/g	ESP	FA	GS
181	P5CDD	6.42 ng/g	ESP	FA	GS
181	H6CDD	[illegible].12 ng/g	ESP	FA	GS
181	H7CDD	2.28 ng/g	ESP	FA	GS
181	OCDD	1.52 ng/g	ESP	FA	GS
181	TCDF	11.85 ng/g	ESP	FA	GS
181	P5CDF	17.2 ng/g	ESP	FA	GS
181	H6CDF	14.3 ng/g	ESP	FA	GS
181	H7CDF	2.9 ng/g	ESP	FA	GS
181	OCDF	0.5 ng/g	ESP	FA	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
196	2378-TCDD	0.41 ng/dscm	STACK	FG	MM5T
196	TCDD	6.3 ng/dscm	STACK	FG	MM5T
196	H6CDD	16 ng/dscm	STACK	FG	MM5T
196	H7CDD	7.6 ng/dscm	STACK	FG	MM5T
196	OCDD	2.5 ng/dscm	STACK	FG	MM5T
196	TCDF	90 ng/dscm	STACK	FG	MM5T
196	H6CDF	62 ng/dscm	STACK	FG	MM5T
196	H7CDF	7.5 ng/dscm	STACK	FG	MM5T
196	OCDF	0.6 ng/dscm	STACK	FG	MM5T
202	PCDD	236.5 ng/g	Stack	FA	N/A
202	PCDF	517.3 ng/g	Stack	FA	N/A
202	TCDD	20.6 ng/g	Stack	FA	N/A
202	TCDF	45.7 ng/g	Stack	FA	N/A
203/1	TCDD	85 ng/g	STACK	FA	GS
203/1	P5CDD	213 ng/g	STACK	FA	GS
203/1	H6CDD	354 ng/g	STACK	FA	GS
203/1	H7CDD	184 ng/g	STACK	FA	GS
203/1	OCDD	97 ng/g	STACK	FA	GS
203/2	TCDD	<0.5 ng/g	STACK	FA	GS
203/2	P5CDD	<0.5 ng/g	STACK	FA	GS
203/2	H6CDD	<0.5 ng/g	STACK	FA	GS
203/2	H7CDD	<0.5 ng/g	STACK	FA	GS
203/2	OCDD	<0.5 ng/g	STACK	FA	GS
203/3	TCDD	2.7 ng/g	STACK	FA	GS
203/3	P5CDD	6.6 ng/g	STACK	FA	GS
203/3	H6CDD	11.6 ng/g	STACK	FA	GS
203/3	H7CDD	5.7 ng/g	STACK	FA	GS
203/3	OCDD	3.5 ng/g	STACK	FA	GS
203/4	TCDD	12.9 ng/g	STACK	FA	GS
203/4	P5CDD	37.5 ng/g	STACK	FA	GS
203/4	H6CDD	75.6 ng/g	STACK	FA	GS
203/4	H7CDD	41.9 ng/g	STACK	FA	GS
203/4	OCDD	35.2 ng/g	STACK	FA	GS
203/5	TCDD	2.4 ng/g	STACK	FA	GS
203/5	P5CDD	7.9 ng/g	STACK	FA	GS
203/5	H6CDD	9.7 ng/g	STACK	FA	GS
203/5	H7CDD	9.1 ng/g	STACK	FA	GS
203/5	OCDD	2.1 ng/g	STACK	FA	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
203/1	TCDF	209 ng/g	STACK	FA	GS
203/1	P5CDF	549 ng/g	STACK	FA	GS
203/1	H6CDF	1082 ng/g	STACK	FA	GS
203/1	H7CDF	499 ng/g	STACK	FA	GS
203/1	OCDF	24 ng/g	STACK	FA	GS
203/2	TCDF	<0.5 ng/g	STACK	FA	GS
203/2	P5CDF	<0.5 ng/g	STACK	FA	GS
203/2	H6CDF	<0.5 ng/g	STACK	FA	GS
203/2	H7CDF	<0.5 ng/g	STACK	FA	GS
203/2	OCDF	<0.5 ng/g	STACK	FA	GS
203/3	TCDF	7.0 ng/g	STACK	FA	GS
203/3	P5CDF	17.8 ng/g	STACK	FA	GS
203/3	H6CDF	32.1 ng/g	STACK	FA	GS
203/3	H7CDF	10.9 ng/g	STACK	FA	GS
203/3	OCDF	0.7 ng/g	STACK	FA	GS
203/4	TCDF	8.2 ng/g	STACK	FA	GS
203/4	P5CDF	19.8 ng/g	STACK	FA	GS
203/4	H6CDF	38.7 ng/g	STACK	FA	GS
203/4	H7CDF	[illegible]0.6 ng/g	STACK	FA	GS
203/4	OCDF	4.0 ng/g	STACK	FA	GS
203/5	TCDF	4.4 ng/g	STACK	FA	GS
203/5	P5CDF	21.0 ng/g	STACK	FA	GS
203/5	H6CDF	21.6 ng/g	STACK	FA	GS
203/5	H7CDF	16.6 ng/g	STACK	FA	GS
203/5	OCDF	<0.5 ng/g	STACK	FA	GS
205/1	2378-TCDD	39 ng/m3	STACK	FG	MM5T
205/1	T4CDD	1243 ng/m3	STACK	FG	MM5T
205/1	P5CDD	3048 ng/m3	STACK	FG	MM5T
205/1	H6CDD	3474 ng/m3	STACK	FG	MM5T
205/1	H7CDD	3122 ng/m3	STACK	FG	MM5T
205/1	OCDD	799 ng/m3	STACK	FG	MM5T
205/1	2378-TCDF	567 ng/m3	STACK	FG	MM5T
205/1	T4CDF	3205 ng/m3	STACK	FG	MM5T
205/1	P5CDF	4817 ng/m3	STACK	FG	MM5T
205/1	H6CDF	4129 ng/m3	STACK	FG	MM5T
205/1	H7CDF	2693 ng/m3	STACK	FG	MM5T
205/1	OCDF	218 ng/m3	STACK	FG	MM5T

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
205/2	2378-TCDD	6 ng/m3	STACK	FG	MM5T
205/2	T4CDD	234 ng/m3	STACK	FG	MM5T
205/2	P5CDD	440 ng/m3	STACK	FG	MM5T
205/2	H6CDD	543 ng/m3	STACK	FG	MM5T
205/2	H7CDD	426 ng/m3	STACK	FG	MM5T
205/2	OCDD	106 ng/m3	STACK	FG	MM5T
205/2	2378-TCDF	114 ng/m3	STACK	FG	MM5T
205/2	T4CDF	916 ng/m3	STACK	FG	MM5T
205/2	P5CDF	1024 ng/m3	STACK	FG	MM5T
205/2	H6CDF	864 ng/m3	STACK	FG	MM5T
205/2	H7CDF	465 ng/m3	STACK	FG	MM5T
205/2	OCDF	30 ng/m3	STACK	FG	MM5T
205/3	2378-TCDD	14 ng/m3	STACK	FG	MM5T
205/3	T4CDD	457 ng/m3	STACK	FG	MM5T
205/3	P5CDD	1045 ng/m3	STACK	FG	MM5T
205/3	H6CDD	1324 ng/m3	STACK	FG	MM5T
205/3	H7CDD	1272 ng/m3	STACK	FG	MM5T
205/3	OCDD	325 ng/m3	STACK	FG	MM5T
205/3	2378-TCDF	232 ng/m3	STACK	FG	MM5T
205/3	T4CDF	1640 ng/m3	STACK	FG	MM5T
205/3	P5CDF	1889 ng/m3	STACK	FG	MM5T
205/3	H6CDF	1665 ng/m3	STACK	FG	MM5T
205/3	H7CDF	1145 ng/m3	STACK	FG	MM5T
205/3	OCDF	81 ng/m3	STACK	FG	MM5T
221	PCDD/PCDF	N/A A	Stack	FA/FG	N/A
222/3	TCDD	474 ng/g	ESP	ASH	GS
222/3	P5CDD	349 ng/g	ESP	ASH	GS
222/3	H6CDD	615 ng/g	ESP	ASH	GS
222/3	H7CDD	370 ng/g	ESP	ASH	GS
222/3	OCDD	162 ng/g	ESP	ASH	GS
222/3	TCDF	419 ng/g	ESP	ASH	GS
222/3	P5CDF	207 ng/g	ESP	ASH	GS
222/3	H6CDF	263 ng/g	ESP	ASH	GS
222/3	H7CDF	287 ng/g	ESP	ASH	GS
222/3	OCDF	[illegible] ng/g	ESP	ASH	GS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
225/1:1	2378-TCDD	28.2 ppb	FURNACE	ASH	GS
225/1:1	TCDD	159.14 ppb	FURNACE	ASH	GS
225/1:1	P5CDD	323.11 ppb	FURNACE	ASH	GS
225/1:1	H6CDD	161.84 ppb	FURNACE	ASH	GS
225/1:1	H7CDD	293.26 ppb	FURNACE	ASH	GS
225/1:1	OCDD	184.45 ppb	FURNACE	ASH	GS
225/1:2	2378-TCDD	3.2 ppb	FURNACE	ASH	GS
225/1:2	TCDD	25.45 ppb	FURNACE	ASH	GS
225/1:2	P5CDD	50.42 ppb	FURNACE	ASH	GS
225/1:2	H6CDD	72.94 ppb	FURNACE	ASH	GS
225/1:2	H7CDD	72.04 ppb	FURNACE	ASH	GS
225/1:2	OCDD	72.17 ppb	FURNACE	ASH	GS
225/2:1:1	2378-TCDD	16.7 ppb	FURNACE	ASH	GS
225/2:1:1	TCDD	243.28 ppb	FURNACE	ASH	GS
225/2:1:1	P5CDD	586.79 ppb	FURNACE	ASH	GS
225/2:1:1	H6CDD	606.69 ppb	FURNACE	ASH	GS
225/2:1:1	H7CDD	330.04 ppb	FURNACE	ASH	GS
225/2:1:1	OCDD	149.31 ppb	FURNACE	ASH	GS
225/2:1:2	2378-TCDD	23 ppb	FURNACE	ASH	GS
225/2:1:2	TCDD	360.62 ppb	FURNACE	ASH	GS
225/2:1:2	P5CDD	718.51 ppb	FURNACE	ASH	GS
225/2:1:2	H6CDD	813.1 ppb	FURNACE	ASH	GS
225/2:1:2	H7CDD	434.37 ppb	FURNACE	ASH	GS
225/2:1:2	OCDD	208.69 ppb	FURNACE	ASH	GS
225/2:2:1	2378-TCDD	3.4 ppb	FURNACE	ASH	GS
225/2:2:1	TCDD	20.33 ppb	FURNACE	ASH	GS
225/2:2:1	P5CDD	43.53 ppb	FURNACE	ASH	GS
225/2:2:1	H6CDD	48.54 ppb	FURNACE	ASH	GS
225/2:2:1	H7CDD	71.67 ppb	FURNACE	ASH	GS
225/2:2:1	OCDD	58.39 ppb	FURNACE	ASH	GS
225/2:2:2	2378-TCDD	4.4 ppb	FURNACE	ASH	GS
225/2:2:2	TCDD	18.17 ppb	FURNACE	ASH	GS
225/2:2:2	P5CDD	48.49 ppb	FURNACE	ASH	GS
225/2:2:2	H6CDD	65.1 ppb	FURNACE	ASH	GS
225/2:2:2	H7CDD	88.33 ppb	FURNACE	ASH	GS
225/2:2:2	OCDD	53.76 ppb	FURNACE	ASH	GS
228	TCDD	19.1 ng/sample	Stack	FA	SSAS

MUNICIPAL SOLID WASTE

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
243	PCDF	+	ESP	FA	GS
243	PCDF	+	Hopper	FA	GS
243	PCDF	+	Stack	FG	M5T

FOSSIL FUEL COMBUSTION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
5/1	2378-TCDD	<.0079 ug/m3	STACK	FG	TRAIN
5/1	2378-TCDF	<.0013 ug/m3	STACK	FG	TRAIN
5/2	2378-TCDD	<.0053 ug/m3	STACK	FG	TRAIN
5/2	2378-TCDF	<.00084 ug/m3	STACK	FG	TRAIN
5/3	2378-TCDD	<.0042 ug/m3	STACK	FG	TRAIN
5/3	2378-TCDF	<.00067 ug/m3	STACK	FG	TRAIN
5/11	2378-TCDD	<.0054 ug/m3	STACK	FG	TRAIN
5/11	2378-TCDF	<.00086 ug/m3	STACK	FG	TRAIN
5/12	2378-TCDD	<.0068 ug/m3	STACK	FG	TRAIN
5/12	2378-TCDF	<.0011 ug/m3	STACK	FG	TRAIN
5/13	2378-TCDD	<.0068 ug/m3	STACK	FG	TRAIN
5/13	2378-TCDF	<.0011 ug/m3	STACK	FG	TRAIN
59	TCDD	ND	N/A	FA	GS
62/OIL	2,3,7,8 TCDD	ND	Stack	FA	GS
62/OIL	H6CDD	2 ppb	Stack	FA	GS
62/OIL	H7CDD	4 ppb	Stack	FA	GS
62/OIL	TCDD	38 ppb	Stack	FA	GS
62/OIL	OCDD	24 ppb	Stack	FA	GS
62/NG	2,3,7,8 TCDD	0.6 ppb	ESP	FA	GS
62/NG	H6CDD	1.0 ppb	ESP	FA	GS
62/NG	H7CDD	34 ppb	ESP	FA	GS
62/NG	TCDD	430 ppb	ESP	FA	GS
62/NG	OCDD	1300 ppb	ESP	FA	GS
94	TCDD	ND	Feed	FA	GS
94	P5CDD	ND	Feed	FA	GS
94	H6CDD	ND	Feed	FA	GS
94	H7CDD	ND	Feed	FA	GS
94	OCDD	ND	Feed	FA	GS
94	TCDF	ND	Feed	FA	GS
94	P5CDF	ND	Feed	FA	GS
94	H6CDF	ND	Feed	FA	GS
94	H7CDF	ND	Feed	FA	GS
94	OCDF	ND	Feed	FA	GS
94	TCDD	ND	Stack	FG	MM5T
94	P5CDD	ND	Stack	FG	MM5T
94	H6CDD	ND	Stack	FG	MM5T

FOSSIL FUEL COMBUSTION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
94	H7CDD	ND	Stack	FG	MM5T
94	OCDD	ND	Stack	FG	MM5T
94	TCDF	ND	Stack	FG	MM5T
94	P5CDF	ND	Stack	FG	MM5T
94	H6CDF	ND	Stack	FG	MM5T
94	H7CDF	ND	Stack	FG	MM5T
94	OCDF	ND	Stack	FG	MM5T
94	TCDD	ND	ESP	FA	GS
94	P5CDD	ND	ESP	FA	GS
94	H6CDD	ND	ESP	FA	GS
94	H7CDD	ND	ESP	FA	GS
94	OCDD	ND	ESP	FA	GS
94	TCDF	ND	ESP	FA	GS
94	P5CDF	ND	ESP	FA	GS
94	H6CDF	ND	ESP	FA	GS
94	H7CDF	ND	ESP	FA	GS
94	OCDF	ND	ESP	FA	GS
97	TCDD	ND	N/A	FA	GS
125	TCDD	ND	Stack	FA	GS

SEWAGE SLUDGE INCINERATORS

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
24	PCDD	10 ng/g	-----	Sludge-Aerobic	N/A
24	PCDD	2 ng/g	-----	Sludge-Aerobic	N/A
24	PCDD	Traces	-----	Sludge-anaerobic	N/A
24	PCDD	Traces	-----	Casting-Aerobic	N/A
24	PCDD	0 ng/g	-----	Cast.-Anaerobic	N/A
24	PCDD	0 ng/g	-----	ASHES	-
24	PCDD	0 ng/g	Stack	FUMES	GS
235	PCDD	0.739 ug/m3	Stack	N/A	N/A
235	PCDF	1.213 ug/m3	Stack	N/A	N/A

WOOD COMBUSTION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
6/A	TCDD	69.86 ug/g FEED	N/A	FG	N/A
6/A	P5CDD	34.72 ug/g FEED	N/A	FG	N/A
6/A	H6CDD	3.92 ug/g FEED	N/A	FG	N/A
6/A	H7CDD	1.72 ug/g FEED	N/A	FG	
6/A	OCDD	1.32 ug/g FEED	N/A	FG	N/A
6/B	TCDD	52.5 ug/g FEED	N/A	FG	N/A
6/B	P5CDD	97.8 ug/g FEED	N/A	FG	N/A
6/B	H6CDD	154.4 ug/g FEED	N/A	FG	N/A
6/B	H7CDD	45.5 ug/g FEED	N/A	FG	N/A
6/B	OCDD	ND	N/A	FG	N/A
7	TCDD	1.4 mg/kg feed	OPEN FIRE	SMOKE	FILTER
7	P5CDD	<0.5 mg/kg feed	OPEN FIRE	SMOKE	FILTER
7	H6CDD	ND	OPEN FIRE	SMOKE	FILTER
7	H7CDD	<0.39 mg/kg feed	OPEN FIRE	SMOKE	FILTER
7	OCDD	ND	OPEN FIRE	SMOKE	FILTER
7	T4CDF	2.72 mg/kg feed	OPEN FIRE	SMOKE	FILTER
7	P5CDF	2.85 mg/kg feed	OPEN FIRE	SMOKE	FILTER
7	H6CDF	1.56 mg/kg feed	OPEN FIRE	SMOKE	FILTER
7	H7CDF	0.89 mg/kg feed	OPEN FIRE	SMOKE	FILTER
7	OCDF	ND	OPEN FIRE	SMOKE	FILTER
54/1	2378-TCDD	ND	CHIMNEY	ASH	GS
54/1	TCDD	1.6 ppt	CHIMNEY	ASH	GS
54/2	2378-TCDD	ND	CHIMNEY	ASH	GS
54/2	TCDD	7.4 ppt	CHIMNEY	ASH	GS
54/3	2378-TCDD	130 ppt	CHIMNEY	ASH	GS
54/3	TCDD	1505 ppt	CHIMNEY	ASH	GS
54/5	2378-TCDD	106 ppt	CHIMNEY	ASH	GS
54/5	TCDD	2513 ppt	CHIMNEY	ASH	GS
54/6	2378-TCDD	1.3 ppt	CHIMNEY	ASH	GS
54/6	TCDD	68.8 ppt	CHIMNEY	ASH	GS
54/7	2378-TCDD	160 ppt	CHIMNEY	ASH	GS
54/7	TCDD	7824 ppt	CHIMNEY	ASH	GS
62/A	2,3,7,8 TCDD	0.1 ppb	CHIMNEY	ASH	SCRAPING
62/A	TCDD	0.37 ppb	CHIMNEY	ASH	SCRAPING
62/A	H6CDD	3.4 ppb	CHIMNEY	ASH	SCRAPING
62/A	H7CDD	16 ppb	CHIMNEY	ASH	SCRAPING
62/A	OCDD	25 ppb	CHIMNEY	ASH	SCRAPING
62/B	TCDD	ND	CHIMNEY	ASH	SCRAPING
62/B	H6CDD	0.23 ppb	CHIMNEY	ASH	SCRAPING
62/B	H7CDD	0.67 ppb	CHIMNEY	ASH	SCRAPING
62/B	OCDD	0.89 ppb	CHIMNEY	ASH	SCRAPING

WOOD COMBUSTION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
165/1	TCDD	1.6 ppt	CHIMNEY	ASH	GS
165/1	H6CDD	21.1 ppt	CHIMNEY	ASH	GS
165/1	H7CDD	63 ppt	CHIMNEY	ASH	GS
165/1	OCDD	95 ppt	CHIMNEY	ASH	GS
165/2	TCDD	7.4 ppt	CHIMNEY	ASH	GS
165/2	H6CDD	32.2 ppt	CHIMNEY	ASH	GS
165/2	H7CDD	65 ppt	CHIMNEY	ASH	GS
165/2	OCDD	110 ppt	CHIMNEY	ASH	GS
165/3	TCDD	1505 ppt	CHIMNEY	ASH	GS
165/3	H6CDD	2400 ppt	CHIMNEY	ASH	GS
165/3	H7CDD	5400 ppt	CHIMNEY	ASH	GS
165/3	OCDD	7200 ppt	CHIMNEY	ASH	GS
165/5	TCDD	2513.6 ppt	CHIMNEY	ASH	GS
165/5	H6CDD	4930 ppt	CHIMNEY	ASH	GS
165/5	H7CDD	2700 ppt	CHIMNEY	ASH	GS
165/5	OCDD	1200 ppt	CHIMNEY	ASH	GS
165/6	TCDD	68.8 ppt	CHIMNEY	ASH	GS
165/6	H6CDD	116 ppt	CHIMNEY	ASH	GS
165/6	H7CDD	194 ppt	CHIMNEY	ASH	GS
165/6	OCDD	190 ppt	CHIMNEY	ASH	GS
165/7	TCDD	7824 ppt	CHIMNEY	ASH	GS
165/7	H6CDD	5600 ppt	CHIMNEY	ASH	GS
165/7	H7CDD	4200 ppt	CHIMNEY	ASH	GS
165/7	OCDD	3400 ppt	CHIMNEY	ASH	GS
165/10	2378-TCDD	8.0 ppt	CHIMNEY	ASH	GS
165/10	TCDD	169 ppt	CHIMNEY	ASH	GS
165/10	H6CDD	1251 ppt	CHIMNEY	ASH	GS
165/10	H7CDD	2500 ppt	CHIMNEY	ASH	GS
165/10	OCDD	2400 ppt	CHIMNEY	ASH	GS
165/11	2378-TCDD	9.2 ppt	CHIMNEY	ASH	GS
165/11	TCDD	146.5 ppt	CHIMNEY	ASH	GS
165/11	H6CDD	7040 ppt	CHIMNEY	ASH	GS
165/11	H7CDD	1800 ppt	CHIMNEY	ASH	GS
165/11	OCDD	1200 ppt	CHIMNEY	ASH	GS
165/12	2378-TCDD	18 ppt	CHIMNEY	ASH	GS
165/12	TCDD	220.8 ppt	CHIMNEY	ASH	GS
165/12	H6CDD	4344 ppt	CHIMNEY	ASH	GS

WOOD COMBUSTION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
165/12	H7CDD	5800 ppt	CHIMNEY	ASH	GS
165/12	OCDD	5200 ppt	CHIMNEY	ASH	GS
165/14	2378-TCDD	20 ppt	CHIMNEY	ASH	GS
165/14	TCDD	471.2 ppt	CHIMNEY	ASH	GS
165/14	H6CDD	9220 ppt	CHIMNEY	ASH	GS
165/14	H7CDD	4100 ppt	CHIMNEY	ASH	GS
165/14	OCDD	490 ppt	CHIMNEY	ASH	GS
165/17	2378-TCDD	6.4 ppt	CHIMNEY	ASH	GS
165/17	TCDD	93.3 ppt	CHIMNEY	ASH	GS
165/17	H6CDD	1982 ppt	CHIMNEY	ASH	GS
165/17	H7CDD	960 ppt	CHIMNEY	ASH	GS
165/17	OCDD	870 ppt	CHIMNEY	ASH	GS
165/18	2378-TCDD	18 ppt	CHIMNEY	ASH	GS
165/18	TCDD	513.9 ppt	CHIMNEY	ASH	GS
165/18	H6CDD	1800 ppt	CHIMNEY	ASH	GS
165/18	H7CDD	4300 ppt	CHIMNEY	ASH	GS
165/18	OCDD	3200 ppt	CHIMNEY	ASH	GS
165/4	2378-TCDD	20 ppt	CHIMNEY	ASH	GS
165/4	TCDD	572.9 ppt	CHIMNEY	ASH	GS
165/4	H6CDD	2700 ppt	CHIMNEY	ASH	GS
165/4	H7CDD	11500 ppt	CHIMNEY	ASH	GS
165/4	OCDD	15400 ppt	CHIMNEY	ASH	GS
165/56	2378-TCDD	110 ppt	CHIMNEY	ASH	GS
165/56	TCDD	20 ppt	CHIMNEY	ASH	GS
165/56	H6CDD	17400 ppt	CHIMNEY	ASH	GS
165/56	H7CDD	25000 ppt	CHIMNEY	ASH	GS
165/56	OCDD	37000 ppt	CHIMNEY	ASH	GS
165/64	2378-TCDD	200 ppt	CHIMNEY	ASH	GS
165/64	TCDD	3147 ppt	CHIMNEY	ASH	GS
165/64	H6CDD	65300 ppt	CHIMNEY	ASH	GS
165/64	H7CDD	39000 ppt	CHIMNEY	ASH	GS
165/64	OCDD	30000 ppt	CHIMNEY	ASH	GS
165/81	2378-TCDD	0.8 ppt	CHIMNEY	ASH	GS
165/81	TCDD	5 ppt	CHIMNEY	ASH	GS
165/81	H6CDD	6.3 ppt	CHIMNEY	ASH	GS
165/81	H7CDD	26 ppt	CHIMNEY	ASH	GS
165/81	OCDD	32 ppt	CHIMNEY	ASH	GS
165/87	2378-TCDD	ND	CHIMNEY	ASH	GS

WOOD COMBUSTION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
165/87	TCDD	ND	CHIMNEY	ASH	GS
165/87	H6CDD	3.2 ppt	CHIMNEY	ASH	GS
165/87	H7CDD	12.5 ppt	CHIMNEY	ASH	GS
165/87	OCDD	24 ppt	CHIMNEY	ASH	GS
165/97	2378-TCDD	NA	CHIMNEY	ASH	GS
165/97	TCDD	NA	CHIMNEY	ASH	GS
165/97	H6CDD	48.4 ppt	CHIMNEY	ASH	GS
165/97	H7CDD	80 ppt	CHIMNEY	ASH	GS
165/97	OCDD	110 ppt	CHIMNEY	ASH	GS
167	TCDD	ND	Flue Pipe	FA/OIL	GS
167	H6CDD	ND	Flue Pipe	FA/OIL	GS
167	H7CDD	18 ppt	Flue Pipe	FA/OIL	GS
167	OCDD	92 ppt	Flue Pipe	FA/OIL	GS
167	TCDD	170 ppt	Flue Pipe	FA/WOOD	GS
167	H6CDD	260 ppt	Flue Pipe	FA/WOOD	GS
167	H7CDD	330 ppt	Flue Pipe	FA/WOOD	GS
167	OCDD	210 ppt	Flue Pipe	FA/WOOD	GS
167	2,3,7,8 TCDD	26 ppt	Chimney	FA	GS
167	TCDD	777 ppt	Chimney	FA	GS
167	H6CDD	3100 ppt	Chimney	FA	GS
167	H7CDD	7200 ppt	Chimney	FA	GS
167	OCDD	10600 ppt	Chimney	FA	GS
179/1	TCDD	29 ppb	N/A	FA	GS
179/1	P5CDD	44 ppb	N/A	FA	GS
179/1	H6CDD	55 ppb	N/A	FA	GS
179/1	H7CDD	20 ppb	N/A	FA	GS
179/1	OCDD	29 ppb	N/A	FA	GS
179/1	TCDF	105 ppb	N/A	FA	GS
179/1	P5CDF	66 ppb	N/A	FA	GS
179/1	H6CDF	26 ppb	N/A	FA	GS
179/1	H7CDF	12 ppb	N/A	FA	GS
179/1	OCDF	8 ppb	N/A	FA	GS
179/2	TCDD	47 ppb	N/A	FA	GS
179/2	P5CDD	61 ppb	N/A	FA	GS
179/2	H6CDD	115 ppb	N/A	FA	GS
179/2	H7CDD	43 ppb	N/A	FA	GS
179/2	OCDD	58 ppb	N/A	FA	GS
179/2	TCDF	97 ppb	N/A	FA	GS
179/2	P5CDF	72 ppb	N/A	FA	GS

WOOD COMBUSTION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
179/2	H6CDF	42 ppb	N/A	FA	GS
179/2	H7CDF	19 ppb	N/A	FA	GS
179/2	OCDF	11 ppb	N/A	FA	GS
179/3	TCDD	1 ppb	N/A	FA	GS
179/3	P5CDD	3 ppb	N/A	FA	GS
179/3	H6CDD	9 ppb	N/A	FA	GS
179/3	H7CDD	7 ppb	N/A	FA	GS
179/3	OCDD	4 ppb	N/A	FA	GS
179/3	TCDF	4 ppb	N/A	FA	GS
179/3	P5CDF	2 ppb	N/A	FA	GS
179/3	H6CDF	3 ppb	N/A	FA	GS
179/3	H7CDF	2 ppb	N/A	FA	GS
179/3	OCDF	1 ppb	N/A	FA	GS
190/A	TCDD	17 ug/g FEED	N/A	ASH	GS
190/A	P5CDD	58 ug/g FEED	N/A	ASH	GS
190/A	H6CDD	74 ug/g FEED	N/A	ASH	GS
190/A	H7CDD	18 ug/g FEED	N/A	ASH	GS
190/A	OCDD	6.4 ug/g FEED	N/A	ASH	GS
190/A	TCDD	35 ug/g FEED	N/A	FG	CHAR. FILT
190/A	P5CDD	90 ug/g FEED	N/A	FG	CHAR. FILT
190/A	H6CDD	80 ug/g FEED	N/A	FG	CHAR. FILT
190/A	H7CDD	8 ug/g FEED	N/A	FG	CHAR. FILT
190/A	OCDD	0.3 ug/g FEED	N/A	FG	CHAR. FILT
190/A	TCDD	26 ug/g FEED	N/A	FG	XAD-2 FILT
190/A	P5CDD	59 ug/g FEED	N/A	FG	XAD-2 FILT
190/A	H6CDD	57 ug/g FEED	N/A	FG	XAD-2 FILT
190/A	H7CDD	8 ug/g FEED	N/A	FG	XAD-2 FILT
190/A	OCDD	0.2 ug/g FEED	N/A	FG	XAD-2 FILT
190/B	TCDD	96 ug/g FEED	N/A	FG	CHAR. FILT
190/B	P5CDD	120 ug/g FEED	N/A	FG	CHAR. FILT
190/B	H6CDD	110 ug/g FEED	N/A	FG	CHAR. FILT
190/B	H7CDD	65 ug/g FEED	N/A	FG	CHAR. FILT
190/B	OCDD	1.2 ug/g FEED	N/A	FG	CHAR. FILT
190/B	TCDD	210 ug/g FEED	N/A	FG	XAD-2 FILT
190/B	P5CDD	357 ug/g FEED	N/A	FG	XAD-2 FILT
190/B	H6CDD	347 ug/g FEED	N/A	FG	XAD-2 FILT
190/B	H7CDD	29 ug/g FEED	N/A	FG	XAD-2 FILT
190/B	OCDD	1.2 ug/g FEED	N/A	FG	XAD-2 FILT
190/C	TCDD	0.4 ug/g FEED	N/A	FEED	GS
190/C	P5CDD	3.5 ug/g FEED	N/A	FEED	GS
190/C	H6CDD	5.3 ug/g FEED	N/A	FEED	GS

WOOD COMBUSTION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
190/C	H7CDD	2.1 ug/g FEED	N/A	FEED	GS
190/C	OCDD	0.3 ug/g FEED	N/A	FEED	GS
190/D	TCDD	30 ug/g FEED	N/A	FG	CHAR. FILT
190/D	P5CDD	84 ug/g FEED	N/A	FG	CHAR. FILT
190/D	H6CDD	82 ug/g FEED	N/A	FG	CHAR. FILT.
190/D	H7CDD	8.2 ug/g FEED	N/A	FG	CHAR. FILT
190/D	OCDD	0.4 ug/g FEED	N/A	FG	CHAR. FILT
190/E	TCDD	0.7 ug/g FEED	N/A	FEED	GS
190/E	P5CDD	5.2 ug/g FEED	N/A	FEED	GS
190/E	H6CDD	9.5 ug/g FEED	N/A	FEED	GS
190/E	H7CDD	5.6 ug/g FEED	N/A	FEED	GS
190/E	OCDD	0.7 ug/g FEED	N/A	FEED	GS
190/F	TCDD	2100 ug/g FEED	N/A	FG	CHAR. FILT
190/F	P5CDD	5.0 ug/g FEED	N/A	FG	CHAR. FILT
190/F	H6CDD	1.0 ug/g FEED	N/A	FG	CHAR. FILT
190/F	H7CDD	3.0 ug/g FEED	N/A	FG	CHAR. FILT
190/F	OCDD	6.0 ug/g FEED	N/A	FG	CHAR. FILT
190/F	PCDD	ND	N/A	FEED	GS
190/G	TCDD	5.2 ug/g FEED	N/A	FG	CHAR. FILT
190/G	P5CDD	14 ug/g FEED	N/A	FG	CHAR. FILT
190/G	H6CDD	56 ug/g FEED	N/A	FG	CHAR. FILT
190/G	H7CDD	172 ug/g FEED	N/A	FG	CHAR. FILT
190/G	OCDD	710 ug/g FEED	N/A	FG	CHAR. FILT
190/G	PCDD	ND	N/A	FEED	GS
220	PCDD/PCDF	ND	Furnace	Ash	GS
220	PCDD/PCDF	ND	Scrubber	Liquid	GS
220	PCDD/PCDF	ND	Stack	FG/FA	MM5T
233/2-1	PCDD	3.72 ng/dscm	STACK	FG	TRAIN
233/2-1	PCDF	9.20 ng/dscm	STACK	FG	TRAIN
233/2-2	PCDD	4.73 ng/dscm	STACK	FG	TRAIN
233/2-2	PCDF	12.36 ng/dscm	STACK	FG	TRAIN
233/2-3	PCDD	26.75 ng/dscm	STACK	FG	TRAIN
233/2-3	PCDF	14.00 ng/dscm	STACK	FG	TRAIN
233/2-4	PCDD	5.96 ng/dscm	STACK	FG	TRAIN
233/2-4	PCDF	16.35 ng/dscm	STACK	FG	TRAIN
233/2-5	PCDD	6.35 ng/dscm	STACK	FG	TRAIN
233/2-5	PCDF	10.44 ng/dscm	STACK	FG	TRAIN
233/2-6	PCDD	57.25 ng/dscm	STACK	FG	TRAIN
233/2-6	PCDF	12.53 ng/dscm	STACK	FG	TRAIN
233/2-7	PCDD	344.55 ng/dscm	STACK	FG	TRAIN

WOOD COMBUSTION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
233/2-7	PCDF	228.42 ng/dscm	STACK	FG	TRAIN
233/2-8	PCDD	159.75 ng/dscm	STACK	FG	TRAIN
233/2-8	PCDF	185.20 ng/dscm	STACK	FG	TRAIN
233/1-4	PCDD	0.7 ng/g	FURNACE	ASH	GS
233/1-4	PCDF	< 0.3 ng/g	FURNACE	ASH	GS
233/1-5	PCDD	0.3 ng/g	FURNACE	ASH	GS
233/1-5	PCDF	< 0.3 ng/g	FURNACE	ASH	GS
233/2-2	PCDD	1.1 ng/g	FURNACE	ASH	GS
233/2-2	PCDD	34.1 ng/g	CYCLONE	ASH	GS
233/2-2	PCDD	675.0 ng/g	BAGHOUSE	ASH	GS
233/2-2	PCDF	1.1 ng/g	FURNACE	ASH	GS
233/2-2	PCDF	37.1 ng/g	CYCLONE	ASH	GS
233/2-2	PCDF	297.0 ng/g	BAGHOUSE	ASH	GS
233/2-3	PCDD	1.1 ng/g	FURNACE	ASH	GS
233/2-3	PCDD	34.1 ng/g	CYCLONE	ASH	GS
233/2-3	PCDD	675.0 ng/g	BAGHOUSE	ASH	GS
233/2-3	PCDF	1.1 ng/g	FURNACE	ASH	GS
233/2-3	PCDF	37.1 ng/g	CYCLONE	ASH	GS
233/2-3	PCDF	297.0 ng/g	BAGHOUSE	ASH	GS
233/2-4	PCDD	1.1 ng/g	FURNACE	ASH	GS
233/2-4	PCDD	34.1 ng/g	CYCLONE	ASH	GS
233/2-4	PCDD	675.0 ng/g	BAGHOUSE	ASH	GS
233/2-4	PCDF	1.1 ng/g	FURNACE	ASH	GS
233/2-4	PCDF	37.1 ng/g	CYCLONE	ASH	GS
233/2-4	PCDF	297.0 ng/g	BAGHOUSE	ASH	GS
233/2-6	PCDD	1.8 ng/g	FURNACE	ASH	GS
233/2-6	PCDD	978.0 ng/g	CYCLONE	ASH	GS
233/2-6	PCDD	9492.0 ng/g	BAGHOUSE	ASH	GS
233/2-6	PCDF	1.8 ng/g	FURNACE	ASH	GS
233/2-6	PCDF	185.0 ng/g	CYCLONE	ASH	GS
233/2-6	PCDF	2272.0 ng/g	BAGHOUSE	ASH	GS
233/2-7	PCDD	1.8 ng/g	FURNACE	ASH	GS
233/2-7	PCDD	978.0 ng/g	CYCLONE	ASH	GS
233/2-7	PCDD	9492.0 ng/g	BAGHOUSE	ASH	GS
233/2-7	PCDF	1.8 ng/g	FURNACE	ASH	GS
233/2-7	PCDF	185.0 ng/g	CYCLONE	ASH	GS
233/2-7	PCDF	2272.0 ng/g	BAGHOUSE	ASH	GS
233/2-8	PCDD	1.8 ng/g	FURNACE	ASH	GS
233/2-8	PCDD	978.0 ng/g	CYCLONE	ASH	GS
233/2-8	PCDD	9492.0 ng/g	BAGHOUSE	ASH	GS
233/2-8	PCDF	1.8 ng/g	FURNACE	ASH	GS
233/2-8	PCDF	185.0 ng/g	CYCLONE	ASH	GS
233/2-8	PCDF	2272.0 ng/g	BAGHOUSE	ASH	GS

BOILERS COFIRING WASTES

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
33	PCDF	0.3 ppm	Stack/ESP	FA	N/A
33	PCDD	0.6 ppm	Stack/ESP	FA	N/A
40/A	T4CDD	ND	-----	FEED	GS
40/A	P5CDD	2.1 ppb	-----	FEED	GS
40/A	H6CDD	360 ppb	-----	FEED	GS
40/A	H7CDD	3600 ppb	-----	FEED	GS
40/A	OCDD	3400 ppb	-----	FEED	GS
40/A	2378-TCDD	ND	-----	FEED	GS
40/A	T4CDD	43 ng/m3	STACK	FG	MM5T
40/A	P5CDD	14 ng/m3	STACK	FG	MM5T
40/A	H6CDD	7.5 ng/m3	STACK	FG	MM5T
40/A	H7CDD	5.5 ng/m3	STACK	FG	MM5T
40/A	OCDD	4.6 ng/m3	STACK	FG	MM5T
40/A	2378-TCDD	ND	STACK	FG	MM5T
40/D1	T4CDD	ND	-----	FEED	GS
40/D1	P5CDD	ND	-----	FEED	GS
40/D1	H6CDD	ND	-----	FEED	GS
40/D1	H7CDD	ND	-----	FEED	GS
40/D1	OCDD	ND	-----	FEED	GS
40/D1	2378-TCDD	ND	-----	FEED	GS
40/D1	T4CDF	ND	-----	FEED	GS
40/D1	P5CDF	ND	-----	FEED	GS
40/D1	H6CDF	ND	-----	FEED	GS
40/D1	H7CDF	ND	-----	FEED	GS
40/D1	OCDF	ND	-----	FEED	GS
40/D1	2378-TCDF	ND	-----	FEED	GS
40/D1	T4CDD	.12 ng/m3	STACK	FG	MM5T
40/D1	P5CDD	.074 ng/m3	STACK	FG	MM5T
40/D1	H6CDD	.10 ng/m3	STACK	FG	MM5T
40/D1	H7CDD	.25 ng/m3	STACK	FG	MM5T
40/D1	OCDD	.26 ng/m3	STACK	FG	MM5T
40/D1	2378-TCDD	ND	STACK	FG	MM5T
40/D1	T4CDF	2.1 ng/m3	STACK	FG	MM5T
40/D1	P5CDF	1.4 ng/m3	STACK	FG	MM5T
40/D1	H6CDF	.77 ng/m3	STACK	FG	MM5T
40/D1	H7CDF	.94 ng/m3	STACK	FG	MM5T
40/D1	OCDF	.27 ng/m3	STACK	FG	MM5T
40/D1	2378-TCDF	.24 ng/m3	STACK	FG	MM5T
40/D2	T4CDD	ND	-----	FEED	GS
40/D2	P5CDD	ND	-----	FEED	GS
40/D2	H6CDD	ND	-----	FEED	GS

BOILERS COFIRING WASTES

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
40/D2	H7CDD	ND	-----	FEED	GS
40/D2	OCDD	ND	-----	FEED	GS
40/D2	2378-TCDD	ND	-----	FEED	GS
40/D2	T4CDF	ND	-----	FEED	GS
40/D2	P5CDF	ND	-----	FEED	GS
40/D2	H6CDF	ND	-----	FEED	GS
40/D2	H7CDF	ND	-----	FEED	GS
40/D2	OCDF	ND	-----	FEED	GS
40/D2	2378-TCDF	ND	-----	FEED	GS
40/D2	T4CDD	.027 ng/m3	STACK	FG	MM5T
40/D2	P5CDD	.032 ng/m3	STACK	FG	MM5T
40/D2	H6CDD	.052 ng/m3	STACK	FG	MM5T
40/D2	H7CDD	.12 ng/m3	STACK	FG	MM5T
40/D2	OCDD	.41 ng/m3	STACK	FG	MM5T
40/D2	2378-TCDD	.002 ng/m3	STACK	FG	MM5T
40/D2	T4CDF	.10 ng/m3	STACK	FG	MM5T
40/D2	P5CDF	.035 ng/m3	STACK	FG	MM5T
40/D2	H6CDF	ND	STACK	FG	MM5T
40/D2	H7CDF	.034 ng/m3	STACK	FG	MM5T
40/D2	OCDF	.07 ng/m3	STACK	FG	MM5T
40/D2	2378-TCDF	.13 ng/m3	STACK	FG	MM5T
40/E	T4CDD	ND	-----	FEED	GS
40/E	P5CDD	ND	-----	FEED	GS
40/E	H6CDD	ND	-----	FEED	GS
40/E	H7CDD	ND	-----	FEED	GS
40/E	OCDD	ND	-----	FEED	GS
40/E	2378-TCDD	ND	-----	FEED	GS
40/E	T4CDF	ND	-----	FEED	GS
40/E	P5CDF	ND	-----	FEED	GS
40/E	H6CDF	ND	-----	FEED	GS
40/E	H7CDF	ND	-----	FEED	GS
40/E	OCDF	ND	-----	FEED	GS
40/E	2378-TCDF	ND	-----	FEED	GS
40/E	T4CDD	ND	STACK	FG	MM5T
40/E	P5CDD	ND	STACK	FG	MM5T
40/E	H6CDD	ND	STACK	FG	MM5T
40/E	H7CDD	ND	STACK	FG	MM5T
40/E	OCDD	ND	STACK	FG	MM5T
40/E	2378-TCDD	ND	STACK	FG	MM5T
40/E	T4CDF	.12 ng/m3	STACK	FG	MM5T
40/E	P5CDF	.019 ng/m3	STACK	FG	MM5T
40/E	H6CDF	ND	STACK	FG	MM5T
40/E	H7CDF	ND	STACK	FG	MM5T
40/E	OCDF	ND	STACK	FG	MM5T
40/E	2378-TCDF	.014 ng/m3	STACK	FG	MM5T

BOILERS COFIRING WASTES

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
40/H	T4CDD	ND	-----	FEED	GS
40/H	P5CDD	ND	-----	FEED	GS
40/H	H6CDD	ND	-----	FEED	GS
40/H	H7CDD	ND	-----	FEED	GS
40/H	OCDD	ND	-----	FEED	GS
40/H	2378-TCDD	ND	-----	FEED	GS
40/H	T4CDF	ND	-----	FEED	GS
40/H	P5CDF	ND	-----	FEED	GS
40/H	H6CDF	ND	-----	FEED	GS
40/H	H7CDF	ND	-----	FEED	GS
40/H	OCDF	ND	-----	FEED	GS
40/H	2378-TCDF	ND	-----	FEED	GS
40/H	T4CDD	ND	STACK	FG	MM5T
40/H	P5CDD	ND	STACK	FG	MM5T
40/H	H6CDD	ND	STACK	FG	MM5T
40/H	H7CDD	ND	STACK	FG	MM5T
40/H	OCDD	ND	STACK	FG	MM5T
40/H	2378-TCDD	ND	STACK	FG	MM5T
40/H	T4CDF	ND	STACK	FG	MM5T
40/H	P5CDF	.14 ng/m3	STACK	FG	MM5T
40/H	H6CDF	.39 ng/m3	STACK	FG	MM5T
40/H	H7CDF	.077 ng/m3	STACK	FG	MM5T
40/H	OCDF	.20 ng/m3	STACK	FG	MM5T
40/H	2378-TCDF	ND	STACK	FG	MM5T
40/L	T4CDD	ND	-----	FEED	GS
40/L	P5CDD	ND	-----	FEED	GS
40/L	H6CDD	ND	-----	FEED	GS
40/L	H7CDD	ND	-----	FEED	GS
40/L	OCDD	ND	-----	FEED	GS
40/L	2378-TCDD	ND	-----	FEED	GS
40/L	T4CDF	ND	-----	FEED	GS
40/L	P5CDF	ND	-----	FEED	GS
40/L	H6CDF	ND	-----	FEED	GS
40/L	H7CDF	ND	-----	FEED	GS
40/L	OCDF	ND	-----	FEED	GS
40/L	2378-TCDF	ND	-----	FEED	GS
40/L	T4CDD	.57 ng/m3	STACK	FG	MM5T
40/L	P5CDD	.01 ng/m3	STACK	FG	MM5T
40/L	H6CDD	.066 ng/m3	STACK	FG	MM5T
40/L	H7CDD	.12 ng/m3	STACK	FG	MM5T
40/L	OCDD	.29 ng/m3	STACK	FG	MM5T
40/L	2378-TCDD	ND	STACK	FG	MM5T
40/L	T4CDF	.61 ng/m3	STACK	FG	MM5T
40/L	P5CDF	.53 ng/m3	STACK	FG	MM5T

BOILERS COFIRING WASTES

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
40/L	H6CDF	.62 ng/m3	STACK	FG	MM5T
40/L	H7CDF	.38 ng/m3	STACK	FG	MM5T
40/L	OCDF	.34 ng/m3	STACK	FG	MM5T
40/L	2378-TCDF	.033 ng/m3	STACK	FG	MM5T
41/A1	2378-TCDD	<1.5 ng/dscm	STACK	FG	MM5T
41/A3	2378-TCDD	<0.4 ng/dscm	STACK	FG	MM5T
41/A1	TCDD	43 ng/dscm	STACK	FG	MM5T
41/A3	TCDD	38 ng/dscm	STACK	FG	MM5T
41/A1	P5CDD	14 ng/dscm	STACK	FG	MM5T
41/A3	P5CDD	24 ng/dscm	STACK	FG	MM5T
41/A1	H6CDD	7.5 ng/dscm	STACK	FG	MM5T
41/A3	H6CDD	12 ng/dscm	STACK	FG	MM5T
41/A1	H7CDD	5.5 ng/dscm	STACK	FG	MM5T
41/A3	H7CDD	1.6 ng/dscm	STACK	FG	MM5T
41/A1	OCDD	4.6 ng/dscm	STACK	FG	MM5T
41/A3	OCDD	0.8 ng/dscm	STACK	FG	MM5T
41/B1	2378-TCDD	NA	FURNACE	ASH	GS
41/B2	2378-TCDD	NA	FURNACE	ASH	GS
41/B3	2378-TCDD	<0.015 ug/kg	FURNACE	ASH	GS
41/B1	TCDD	<0.20 ug/kg	FURNACE	ASH	GS
41/B2	TCDD	0.20 ug/kg	FURNACE	ASH	GS
41/B3	TCDD	0.28 ug/kg	FURNACE	ASH	GS
41/B1	P5CDD	<0.20 ug/kg	FURNACE	ASH	GS
41/B2	P5CDD	0.16 ug/kg	FURNACE	ASH	GS
41/B3	P5CDD	0.24 ug/kg	FURNACE	ASH	GS
41/B1	H6CDD	<0.20 ug/kg	FURNACE	ASH	GS
41/B2	H6CDD	1.2 ug/kg	FURNACE	ASH	GS
41/B3	H6CDD	2.1 ug/kg	FURNACE	ASH	GS
41/B1	H7CDD	11 ug/kg	FURNACE	ASH	GS
41/B2	H7CDD	8.0 ug/kg	FURNACE	ASH	GS
41/B3	H7CDD	14 ug/kg	FURNACE	ASH	GS
41/B1	OCDD	32 ug/kg	FURNACE	ASH	GS
41/B2	OCDD	28 ug/kg	FURNACE	ASH	GS
41/B3	OCDD	48 ug/kg	FURNACE	ASH	GS
41/D	PCDD	ND	Stack	FG/FA	MM5T
41/E	PCDD	ND	Stack	FG/FA	MM5T
41/G	PCDD	ND	Stack	FG/FA	MM5T
57	TCDF	ND	Feed	Sludge	GS
57	PCDF	92.1 ng/g	Composit	Ash	GS
57	PCDF	18.2 ng/g	Feed	Sludge	GS
57	PCDD	209 ng/g	Composit	Ash	GS
57	TCDD	2.5 ng/g	Composit	Ash	GS

BOILERS COFIRING WASTES

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
57	PCDD/PCDF	ND	Stack	FG	Train
57	TCDD	ND	Feed	Sludge	GS
57	PCDD	306 ng/g	Feed	Sludge	GS
57	TCDF	3.7 ng/g	Composit	Ash	GS
74	TCDD	ND	Residue	Ash	GS
74	P5CDD	4.5 ng/g	Residue	Ash	GS
74	H6CDD	110 ng/g	Residue	Ash	GS
74	H7CDD	380 ng/g	Residue	Ash	GS
74	OCDD	43 ng/g	Residue	Ash	GS
74	TCDF	13 ng/g	Residue	Ash	GS
74	P5CDF	470 ng/g	Residue	Ash	GS
74	H6CDF	1300 ng/g	Residue	Ash	GS
74	H7CDF	520 ng/g	Residue	Ash	GS
74	OCDF	550 ng/g	Residue	Ash	GS
81/A	TCDD	ND	STACK	FG	TRAIN
81/A	OCDD	ND	STACK	FG	TRAIN
81/C	TCDD	ND	STACK	FG	TRAIN
81/C	OCDD	4.5 ug/m3	STACK	FG	TRAIN
81/D	TCDD	ND	STACK	FG	TRAIN
81/D	OCDD	ND	STACK	FG	TRAIN
81/E	TCDD	ND	STACK	FG	TRAIN
81/E	OCDD	ND	STACK	FG	TRAIN
81/F	TCDD	ND	STACK	FG	TRAIN
81/F	OCDD	17 ug/m3	STACK	FG	TRAIN
81/G	TCDD	1.4 ug/m3	STACK	FG	TRAIN
81/G	OCDD	ND	STACK	FG	TRAIN
81/A	TCDF	ND	STACK	FG	TRAIN
81/C	TCDF	ND	STACK	FG	TRAIN
81/D	TCDF	ND	STACK	FG	TRAIN
81/E	TCDF	0.17 ug/m3	STACK	FG	TRAIN
81/F	TCDF	ND	STACK	FG	TRAIN
81/G	TCDF	ND	STACK	FG	TRAIN
81/D	TCDD	ND	FIRETUBE	FA	GS
81/D	P5CDD	178 ng/g	FIRETUBE	FA	GS
81/D	H6CDD	290 ng/g	FIRETUBE	FA	GS
81/D	H7CDD	360 ng/g	FIRETUBE	FA	GS
81/D	OCDD	183 ng/g	FIRETUBE	FA	GS
81/D	TCDF	531 ng/g	FIRETUBE	FA	GS
81/D	P5CDF	1720 ng/g	FIRETUBE	FA	GS
81/D	H6CDF	540 ng/g	FIRETUBE	FA	GS
81/D	H7CDF	920 ng/g	FIRETUBE	FA	GS

BOILERS COFIRING WASTES

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
81/D	OCDF	66 ng/g	FIRETUBE	FA	GS
95	PCDD/PCDF	ND	STACK	FG	MM5T
96	PCDD	ND	STACK	FG/FA	SASS
193	PCDF	ND	FURNACE	ASH	GS
193	TCDF	ND	FURNACE	ASH	GS
193	TCDD	0.31 ug/g	FURNACE	ASH	GS
193	PCDD	0.01 ug/g	FURNACE	ASH	GS
193	PCDF	2.6 ug/g	BAGHOUSE	ASH	GS
193	TCDF	0.90 ug/g	BAGHOUSE	ASH	GS
193	PCDD	5.2 ug/g	BAGHOUSE	ASH	GS
193	TCDD	0.96 ug/g	BAGHOUSE	ASH	GS

HAZARDOUS WASTE INCINERATOR

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
1/1	TCDD	ND	----	FEED	GS
1/1	TCDD	ND	STACK	FG	MM5T
1/1	TCDD	2.5 ug/ml	----	FEED	GS
1/1	TCDD	ND	STACK	FG	MM5T
1/2	TCDD	2.8 ug/ml	----	FEED	GS
1/2	TCDD	ND	STACK	FG	MM5T
1/2	TCDD	0.136 ng/ml	STACK	FG	MM5T
1/2	TCDD	3.34 ng/ml	STACK	FG	MM5T
1/2	TCDD	1 ug/ml	----	FEED	GS
1/2	TCDD	ND	STACK	FG	MM5T
1/3	TCDD	2.8 ug/ml	----	FEED	GS
1/3	TCDD	ND	STACK	FG	MM5T
2	TCDD	ND	-----	Feed	GS
2	TCDD	ND	Stack	FG	BIT
2/3	TCDF	42 ng/g	----	Feed	GS
2/4	TCDF	80 ng/g	----	Feed	GS
2/7	TCDF	42 ng/g	----	Feed	GS
2/8	TCDF	25 ng/g	----	Feed	GS
2/9	TCDF	38 ng/g	----	Feed	GS
2/10	TCDF	58 ng/g	----	Feed	GS
2/3	TCDF	<3 ng/m3	Stack	FG	BIT
2/3	TCDF	<2 ng/m3	Stack	FG	BIT
2/4	TCDF	NA	Stack	FG	BIT
2/7	TCDF	NA	Stack	FG	BIT
2/8	TCDF	<0.7 ng/m3	Stack	FG	BIT
2/9	TCDF	NA	Stack	FG	BIT
2/9	TCDF	NA	Stack	FG	BIT
2/10	TCDF	<1 ng/m3	Stack	FG	BIT
2/10	TCDF	<0.3 ng/m3	Stack	FG	BIT
21/2AA	PCDD	< 1 ng/m3	STACK	FG	TRAIN
21/2AA	H6CDD	< 1 ng/m3	STACK	FG	TRAIN
21/2AA	H7CDD	< 1 ng/m3	STACK	FG	TRAIN
21/2AA	08CDD	2.3 ng/m3	STACK	FG	TRAIN
21/2AB	PCDD	< 1 ng/m3	STACK	FG	TRAIN
21/2AB	H6CDD	< 2 ng/m3	STACK	FG	TRAIN
21/2AB	H7CDD	< 1 ng/m3	STACK	FG	TRAIN
21/2AB	O8CDD	< 1 ng/m3	STACK	FG	TRAIN
21/2BA	PCDD	< 1 ng/m3	STACK	FG	TRAIN
21/2BA	H6CDD	< 2 ng/m3	STACK	FG	TRAIN
21/2BA	H7CDD	< 2 ng/m3	STACK	FG	TRAIN
21/2BA	O8CDD	< 1 ng/m3	STACK	FG	TRAIN
21/2BB	PCDD	< 1 ng/m3	STACK	FG	TRAIN

HAZARDOUS WASTE INCINERATOR

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
21/2BB	H6CDD	< 1 ng/m3	STACK	FG	TRAIN
21/2BB	H7CDD	< 1 ng/m3	STACK	FG	TRAIN
21/2BB	O8CDD	< 2 ng/m3	STACK	FG	TRAIN
62/TB	TCDD	ND	Stack	FA	GS
62/TB	H6CDD	7.6 ppb	Stack	FA	GS
62/TB	H7CDD	91 ppb	Stack	FA	GS
62/TB	OCDD	306 ppb	Stack	FA	GS
62/RK	2,3,7,8 TCDD	ND	Stack	FA/FUEL	GS
62/RK	TCDD	ND	Stack	FA/FUEL	GS
62/RK	H6CDD	2.1 ppb	Stack	FA/FUEL	GS
62/RK	H6CDD	21225 ppb	Stack	FA/FUEL	GS
62/RK	H6CDD	200 ppb	Scrubber	FA/FUEL	FILTERED
62/RK	H7CDD	970 ppb	Scrubber	FA/FUEL	FILTERED
62/RK	2,3,7,8 TCDD	55 ppb	Stack	FA/NO FUEL	GS
62/RK	TCDD	7705 ppb	Stack	FA/NO FUEL	GS
62/RK	H7CDD	164750 ppb	Stack	FA/NO FUEL	GS
62/RK	H7CDD	32 ppb	Stack	FA/NO FUEL	GS
62/RK	OCDD	263000 ppb	Stack	FA/NO FUEL	GS
62/RK	TCDD	46 ppb	Scrubber	FA/NO FUEL	FILTERED
62/RK	TCDD	2500 ppb	Scrubber	FA/NO FUEL	FILTERED
62/RK	H6CDD	3400 ppb	Scrubber	FA/NO FUEL	FILTERED
62/RK	H7CDD	26000 ppb	Scrubber	FA/NO FUEL	FILTERED
62/RK	OCDD	42000 ppb	Scrubber	FA/NO FUEL	FILTERED
62/RK	OCDD	1200 ppb	Scrubber	FA/NO FUEL	FILTERED
88/1	T4CDD	2.4E-9 g/dscm	STACK	FG	MM5T
88/1	T4CDF	9.7E-9 g/DSCM	STACK	FG	MM5T
88/1	P5CDD	ND	STACK	FG	MM5T
88/1	P5CDF	1.9E-9 g/dscm	STACK	FG	MM5T
88/1	H6CDD	ND	STACK	FG	MM5T
88/1	H6CDF	ND	STACK	FG	MM5T
88/1	H7CDD	ND	STACK	FG	MM5T
88/1	H7CDF	ND	STACK	FG	MM5T
88/1	OCDD	7.3E-9 g/dscm	STACK	FG	MM5T
88/1	OCDF	ND	STACK	FG	MM5T
88/2	T4CDD	1.4E-8 g/dscm	STACK	FG	MM5T
88/2	T4CDF	1.7E-9 g/dscm	STACK	FG	MM5T
88/2	P5CDD	ND	STACK	FG	MM5T
88/2	P5CDF	6.8E-9 g/dscm	STACK	FG	MM5T
88/2	H6CDD	ND	STACK	FG	MM5T
88/2	H6CDF	ND	STACK	FG	MM5T
88/2	H7CDD	ND	STACK	FG	MM5T

HAZARDOUS WASTE INCINERATOR

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
88/2	H7CDF	ND	STACK	FG	MM5T
88/2	OCDD	ND	STACK	FG	MM5T
88/2	OCDF	1.7E-9 g/dscm	STACK	FG	MM5T
88/3	T4CDD	3.4E-9 g/dscm	STACK	FG	MM5T
88/3	T4CDF	ND	STACK	FG	MM5T
88/3	P5CDD	ND	STACK	FG	MM5T
88/3	P5CDF	2.5E-9 g/dscm	STACK	FG	MM5T
88/3	H6CDD	ND	STACK	FG	MM5T
88/3	H6CDF	ND	STACK	FG	MM5T
88/3	H7CDD	ND	STACK	FG	MM5T
88/3	H7CDF	ND	STACK	FG	MM5T
88/3	OCDD	8.4E-9 g/dscm	STACK	FG	MM5T
88/3	OCDF	ND	STACK	FG	MM5T
88/4	T4CDD	7.5E-9 g/dscm	STACK	FG	MM5T
88/4	T4CDF	1.5E-9 g/dscm	STACK	FG	MM5T
88/4	P5CDD	ND	STACK	FG	MM5T
88/4	P5CDF	7.5E-9 g/dscm	STACK	FG	MM5T
88/4	H6CDD	ND	STACK	FG	MM5T
88/4	H6CDF	ND	STACK	FG	MM5T
88/4	H7CDD	ND	STACK	FG	MM5T
88/4	H7CDF	3.8E-9 g/dscm	STACK	FG	MM5T
88/4	OCDD	3.8E-8 g/dscm	STACK	FG	MM5T
88/4	OCDF	7.5E-9 g/dscm	STACK	FG	MM5T
108/3	TCDD	ND	STACK	FG	MM5T
108/3	P5CDD	ND	STACK	FG	MM5T
108/3	H6CDD	ND	STACK	FG	MM5T
108/3	H7CDD	ND	STACK	FG	MM5T
108/3	OCDD	25 ng/samp.	STACK	FG	MM5T
108/3	TCDF	ND	STACK	FG	MM5T
108/3	P5CDF	ND	STACK	FG	MM5T
108/3	H6CDF	ND	STACK	FG	MM5T
108/3	H7CDF	ND	STACK	FG	MM5T
108/3	OCDF	ND	STACK	FG	MM5T
108/4	TCDD	ND	STACK	FG	MM5T
108/4	P5CDD	ND	STACK	FG	MM5T
108/4	H6CDD	ND	STACK	FG	MM5T
108/4	H7CDD	ND	STACK	FG	MM5T
108/4	OCDD	8.7 ng/samp.	STACK	FG	MM5T
108/4	TCDF	ND	STACK	FG	MM5T
108/4	P5CDF	ND	STACK	FG	MM5T
108/4	H6CDF	ND	STACK	FG	MM5T

HAZARDOUS WASTE INCINERATOR

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
108/4	H7CDF	ND	STACK	FG	MM5T
108/4	OCDF	ND	STACK	FG	MM5T
108/5	TCDD	ND	STACK	FG	MM5T
108/5	P5CDD	ND	STACK	FG	MM5T
108/5	H6CDD	ND	STACK	FG	MM5T
108/5	H7CDD	ND	STACK	FG	MM5T
108/5	OCDD	57.6 ng/samp.	STACK	FG	MM5T
108/5	TCDF	ND	STACK	FG	MM5T
108/5	P5CDF	ND	STACK	FG	MM5T
108/5	H6CDF	ND	STACK	FG	MM5T
108/5	H7CDF	ND	STACK	FG	MM5T
108/5	OCDF	ND	STACK	FG	MM5T
136	PCDD/PCDF	ND	Stack	PART	MM5T
153A/1	TCDD	47.72 ng/m3	STACK	FG	MM5T
153A/1	P5CDD	6.52 ng/m3	STACK	FG	MM5T
153A/1	H6CDD	-	STACK	FG	MM5T
153A/1	H7CDD	0.21 ng/m3	STACK	FG	MM5T
153A/1	OCDD	0.64 ng/m3	STACK	FG	MM5T
153A/1	TCDF	86.07 ng/m3	STACK	FG	MM5T
153A/1	P5CDF	13.61 ng/m3	STACK	FG	MM5T
153A/1	H6CDF	2.65 ng/m3	STACK	FG	MM5T
153A/1	H7CDF	0.26 ng/m3	STACK	FG	MM5T
153A/1	OCDF	0.06 ng/m3	STACK	FG	MM5T
153A/2	TCDD	43.75 ng/m3	STACK	FG	MM5T
153A/2	P5CDD	1.94 ng/m3	STACK	FG	MM5T
153A/2	H6CDD	0.37 ng/m3	STACK	FG	MM5T
153A/2	H7CDD	0.84 ng/m3	STACK	FG	MM5T
153A/2	OCDD	2.53 ng/m3	STACK	FG	MM5T
153A/2	TCDF	76.98 ng/m3	STACK	FG	MM5T
153A/2	P5CDF	4.28 ng/m3	STACK	FG	MM5T
153A/2	H6CDF	1.95 ng/m3	STACK	FG	MM5T
153A/2	H7CDF	0.55 ng/m3	STACK	FG	MM5T
153A/2	OCDF	0.17 ng/m3	STACK	FG	MM5T
153A/3	TCDD	4.92 ng/m3	STACK	FG	MM5T
153A/3	OCDD	0.46 ng/m3	STACK	FG	MM5T
153A/3	TCDF	94.53 ng/m3	STACK	FG	MM5T
153A/3	P5CDF	0.18 ng/m3	STACK	FG	MM5T
*161/A	TCDD	ND	-----	Feed	GS
*161/A	TCDF	Detected	-----	Feed	GS
*161/A	TCDD	ND	Stack	FG/FA	MM5T

HAZARDOUS WASTE INCINERATOR

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
*161/A	TCDF	0.7 ng/m3	Stack	FG/FA	MM5T
*161/B	TCDD	ND	Stack	FG/FA	MM5T
*161/B	TCDF	ND	Stack	FG/FA	MM5T
*161/B	TCDD	ND	-----	Feed	GS
*161/B	TCDF	ND	-----	Feed	GS
*161/C	TCDD	ND	Stack	FG/FA	MM5T
*161/C	TCDD	ND	-----	Feed	GS
*161/C	TCDF	Detected	-----	Feed	GS
*161/D	TCDD	ND	Stack	FG/FA	MM5T
*161/D	TCDF	ND	Stack	FG/FA	MM5T
*161/D	TCDD	ND	-----	Feed	GS
*161/D	TCDF	ND	-----	Feed	GS
*161/E	TCDD	ND	-----	Feed	GS
*161/E	TCDF	ND	-----	Feed	GS
*161/E	TCDD	ND	Stack	FG/FA	MM5T
*161/E	TCDF	ND	Stack	FG/FA	MM5T
*161/F	TCDD	Detected	-----	Feed	GS
*161/F	TCDD	15 ng/m3	Stack	FG/FA	MM5T
*161/F	TCDF	40 ng/m3	Stack	FG/FA	MM5T
162/1	TCDD	0 ng/ml	STACK	FG	TRAIN
162/1	P5CDD	0 ng/ml	STACK	FG	TRAIN
162/1	H6CDD	0 ng/ml	STACK	FG	TRAIN
162/1	H7CDD	---	STACK	FG	TRAIN
162/1	OCDD	---	STACK	FG	TRAIN
162/1	TCDF	54 ng/ml	STACK	FG	TRAIN
162/1	P5CDF	N/A	STACK	FG	TRAIN
162/1	H6CDF	ND	STACK	FG	TRAIN
162/1	H7CDF	ND	STACK	FG	TRAIN
162/1	OCDF	ND	STACK	FG	TRAIN
162/2	TCDD	0 ng/ml	STACK	FG	TRAIN
162/2	P5CDD	0 ng/ml	STACK	FG	TRAIN
162/2	H6CDD	28 ng/ml	STACK	FG	TRAIN
162/2	H7CDD	---	STACK	FG	TRAIN
162/2	OCDD	---	STACK	FG	TRAIN
162/2	TCDF	23 ng/ml	STACK	FG	TRAIN
162/2	P5CDF	0 ng/ml	STACK	FG	TRAIN
162/2	H6CDF	0 ng/ml	STACK	FG	TRAIN
162/2	H7CDF	---	STACK	FG	TRAIN
162/2	OCDF	---	STACK	FG	TRAIN

HAZARDOUS WASTE INCINERATOR

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
162/3	TCDD	0 ng/ml	STACK	FG	TRAIN
162/3	P5CDD	0 ng/ml	STACK	FG	TRAIN
162/3	H6CDD	0 ng/ml	STACK	FG	TRAIN
162/3	H7CDD	---	STACK	FG	TRAIN
162/3	O8CDD	---	STACK	FG	TRAIN
162/3	TCDF	0 ng/ml	STACK	FG	TRAIN
162/3	P5CDF	120 ng/ml	STACK	FG	TRAIN
162/3	H6CDF	0 ng/ml	STACK	FG	TRAIN
162/3	H7CDF	---	STACK	FG	TRAIN
162/3	OCDF	---	STACK	FG	TRAIN
162/4	TCDD	0 ng/ml	STACK	FG	TRAIN
162/4	P5CDD	11 ng/ml	STACK	FG	TRAIN
162/4	H6CDD	0 ng/ml	STACK	FG	TRAIN
162/4	H7CDD	---	STACK	FG	TRAIN
162/4	OCDD	---	STACK	FG	TRAIN
162/4	TCDF	10 ng/ml	STACK	FG	TRAIN
162/4	P5CDF	170 ng/ml	STACK	FG	TRAIN
162/4	H6CDF	0 ng/ml	STACK	FG	TRAIN
162/4	H7CDF	---	STACK	FG	TRAIN
162/4	OCDF	---	STACK	FG	TRAIN
162/5	TCDD	0 ng/ml	STACK	FG	TRAIN
162/5	P5CDD	0 ng/ml	STACK	FG	TRAIN
162/5	H6CDD	0 ng/ml	STACK	FG	TRAIN
162/5	H7CDD	---	STACK	FG	TRAIN
162/5	OCDD	---	STACK	FG	TRAIN
162/5	TCDF	130 ng/ml	STACK	FG	TRAIN
162/5	P5CDF	48 ng/ml	STACK	FG	TRAIN
162/5	H6CDF	10 ng/ml	STACK	FG	TRAIN
162/5	H7CDF	---	STACK	FG	TRAIN
162/5	OCDF	---	STACK	FG	TRAIN
162/6	TCDD	0 ng/ml	STACK	FG	TRAIN
162/6	P5CDD	0 ng/ml	STACK	FG	TRAIN
162/6	H6CDD	140 ng/ml	STACK	FG	TRAIN
162/6	H7CDD	---	STACK	FG	TRAIN
162/6	OCDD	---	STACK	FG	TRAIN
162/6	TCDF	96 ng/ml	STACK	FG	TRAIN
162/6	P5CDF	25 ng/ml	STACK	FG	TRAIN
162/6	H6CDF	0 ng/ml	STACK	FG	TRAIN
162/6	H7CDF	0 ng/ml	STACK	FG	TRAIN
162/6	OCDF	0 ng/ml	STACK	FG	TRAIN
162/7	TCDD	0 ng/ml	STACK	FG	TRAIN

HAZARDOUS WASTE INCINERATOR

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
162/7	P5CDD	0 ng/ml	STACK	FG	TRAIN
162/7	H6CDD	0 ng/ml	STACK	FG	TRAIN
162/7	H7CDD	0 ng/ml	STACK	FG	TRAIN
162/7	OCDD	0 ng/ml	STACK	FG	TRAIN
162/7	TCDF	92 ng/ml	STACK	FG	TRAIN
162/7	P5CDF	78 ng/ml	STACK	FG	TRAIN
162/7	H6CDF	0 ng/ml	STACK	FG	TRAIN
162/7	H7CDF	0 ng/ml	STACK	FG	TRAIN
162/7	OCDF	0 ng/ml	STACK	FG	TRAIN
162/8	TCDD	0 ng/ml	STACK	FG	TRAIN
162/8	P5CDD	0 ng/ml	STACK	FG	TRAIN
162/8	H6CDD	0 ng/ml	STACK	FG	TRAIN
162/8	H7CDD	0 ng/ml	STACK	FG	TRAIN
162/8	OCDD	0 mg/ml	STACK	FG	TRAIN
162/8	TCDF	92 ng/ml	STACK	FG	TRAIN
162/8	P5CDF	78 ng/ml	STACK	FG	TRAIN
162/8	H6CDF	0 ng/mL	STACK	FG	TRAIN
162/8	H7CDF	0 ng/ml	STACK	FG	TRAIN
162/8	OCDF	0 ng/ml	STACK	FG	TRAIN
162/9	TCDD	---	STACK	FG	TRAIN
162/9	P5CDD	0 ng/ml	STACK	FG	TRAIN
162/9	H6CDD	17 ng/ml	STACK	FG	TRAIN
162/9	H7CDD	0 ng/ml	STACK	FG	TRAIN
162/9	OCDD	0 ng/ml	STACK	FG	TRAIN
162/9	TCDF	---	STACK	FG	TRAIN
162/9	P5CDF	790 ng/ml	STACK	FG	TRAIN
162/9	H6CDF	170 ng/ml	STACK	FG	TRAIN
162/9	H7CDF	0 ng/ml	STACK	FG	TRAIN
162/9	OCDF	0 ng/ml	STACK	FG	TRAIN
162/10	TCDD	0 ng/ml	STACK	FG	TRAIN
162/10	P5CDD	0 ng/ml	STACK	FG	TRAIN
162/10	H6CDD	0 ng/ml	STACK	FG	TRAIN
162/10	H7CDD	0 ng/ml	STACK	FG	TRAIN
162/10	OCDD	0 ng/ml	STACK	FG	TRAIN
162/10	TCDF	830 ng/ml	STACK	FG	TRAIN
162/10	P5CDF	52 ng/ml	STACK	FG	TRAIN
162/10	H6CDF	9 ng/ml	STACK	FG	TRAIN
162/10	H7CDF	0 ng/ml	STACK	FG	TRAIN
162/10	OCDF	0 ng/ml	STACK	FG	TRAIN
162/11	TCDD	0 ng/ml	STACK	FG	TRAIN
162/11	P5CDD	0 ng/ml	STACK	FG	TRAIN
162/11	H6CDD	0 ng/ml	STACK	FG	TRAIN

HAZARDOUS WASTE INCINERATOR

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
162/11	H7CDD	0 ng/ml	STACK	FG	TRAIN
162/11	OCDD	0 ng/ml	STACK	FG	TRAIN
162/11	TCDF	760 ng/ml	STACK	FG	TRAIN
162/11	P5CDF	210 ng/ml	STACK	FG	TRAIN
162/11	H6CDF	16 ng/ml	STACK	FG	TRAIN
162/11	H7CDF	0 ng/ml	STACK	FG	TRAIN
162/11	OCDF	0 ng/ml	STACK	FG	TRAIN
162/12	TCDD	N/A	STACK	FG	TRAIN
162/12	P5CDD	N/A	STACK	FG	TRAIN
162/12	H6CDD	N/A	STACK	FG	TRAIN
162/12	H7CDD	N/A	STACK	FG	TRAIN
162/12	OCDD	N/A	STACK	FG	TRAIN
162/12	TCDF	N/A	STACK	FG	TRAIN
162/12	P5CDF	N/A	STACK	FG	TRAIN
162/12	H6CDF	N/A	STACK	FG	TRAIN
162/12	H7CDF	N/A	STACK	FG	TRAIN
162/12	OCDF	N/A	STACK	FG	TRAIN
162/13	TCDD	0 ng/ml	STACK	FG	TRAIN
162/13	P5CDD	10 ng/ml	STACK	FG	TRAIN
162/13	H6CDD	0 ng/ml	STACK	FG	TRAIN
162/13	H7CDD	---	STACK	FG	TRAIN
162/13	OCDD	---	STACK	FG	TRAIN
162/13	TCDF	980 ng/ml	STACK	FG	TRAIN
162/13	P5CDF	450 ng/ml	STACK	FG	TRAIN
162/13	H6CDF	60 ng/ml	STACK	FG	TRAIN
162/13	H7CDF	0 ng/ml	STACK	FG	TRAIN
162/13	OCDF	0 ng/ml	STACK	FG	TRAIN
162/14	TCDD	0 ng/ml	STACK	FG	TRAIN
162/14	P5CDD	2 ng/ml	STACK	FG	TRAIN
162/14	H6CDD	0 ng/ml	STACK	FG	TRAIN
162/14	H7CDD	---	STACK	FG	TRAIN
162/14	OCDD	---	STACK	FG	TRAIN
162/14	TCDF	2500 ng/ml	STACK	FG	TRAIN
162/14	P5CDF	210 ng/ml	STACK	FG	TRAIN
162/14	H6CDF	15 ng/ml	STACK	FG	TRAIN
162/14	H7CDF	0 ng/ml	STACK	FG	TRAIN
162/14	OCDF	0 ng/ml	STACK	FG	TRAIN
162/15	TCDD	N/A	STACK	FG	TRAIN
162/15	P5CDD	N/A	STACK	FG	TRAIN
162/15	H6CDD	N/A	STACK	FG	TRAIN
162/15	H7CDD	N/A	STACK	FG	TRAIN
162/15	OCDD	N/A	STACK	FG	TRAIN

HAZARDOUS WASTE INCINERATOR

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
162/15	TCDF	N/A	STACK	FG	TRAIN
162/15	P5CDF	N/A	STACK	FG	TRAIN
162/15	H6CDF	N/A	STACK	FG	TRAIN
162/15	H7CDF	N/A	STACK	FG	TRAIN
162/15	OCDF	N/A	STACK	FG	TRAIN
162/16	TCDD	12 ng/ml	STACK	FG	TRAIN
162/16	P5CDD	NQ	STACK	FG	TRAIN
162/16	H6CDD	NQ	STACK	FG	TRAIN
162/16	H7CDD	180 ng/ml	STACK	FG	TRAIN
162/16	OCDD	33 ng/ml	STACK	FG	TRAIN
162/16	TCDF	NQ	STACK	FG	TRAIN
162/16	P5CDF	NQ	STACK	FG	TRAIN
162/16	H6CDF	NQ	STACK	FG	TRAIN
162/16	H7CDF	16000 ng/ml	STACK	FG	TRAIN
162/16	OCDF	1800 ng/ml	STACK	FG	TRAIN
162/17	TCDD	0 ng/ml	STACK	FG	TRAIN
162/17	P5CDD	0 ng/ml	STACK	FG	TRAIN
162/17	H6CDD	0 ng/ml	STACK	FG	TRAIN
162/17	H7CDD	690 ng/ml	STACK	FG	TRAIN
162/17	OCDD	78 ng/ml	STACK	FG	TRAIN
162/17	TCDF	3 E-6 ng/ml	STACK	FG	TRAIN
162/17	P5CDF	1.4 E-7 ng/ml	STACK	FG	TRAIN
162/17	H6CDF	1.9 e-6 ng/ml	STACK	FG	TRAIN
162/17	H7CDF	61000 ng/ml	STACK	FG	TRAIN
162/17	OCDF	7200 ng/ml	STACK	FG	TRAIN
162/18	TCDD	0 ng/ml	STACK	FG	TRAIN
162/18	P5CDD	0 ng/ml	STACK	FG	TRAIN
162/18	H6CDD	0 ng/ml	STACK	FG	TRAIN
162/18	H7CDD	490 ng/ml	STACK	FG	TRAIN
162/18	OCDD	110 ng/ml	STACK	FG	TRAIN
162/18	TCDF	2.4 E-6 ng/ml	STACK	FG	TRAIN
162/18	P5CDF	9.9 E-6 ng/ml	STACK	FG	TRAIN
162/18	H6CDF	1.4 E-6 ng/ml	STACK	FG	TRAIN
162/18	H7CDF	39000 ng/ml	STACK	FG	TRAIN
162/18	OCDF	2700 ng/ml	STACK	FG	TRAIN
162/19	TCDD	N/A	STACK	FG	TRAIN
162/19	P5CDD	N/A	STACK	FG	TRAIN
162/19	H6CDD	N/A	STACK	FG	TRAIN
162/19	H7CDD	N/A	STACK	FG	TRAIN
162/19	OCDD	N/A	STACK	FG	TRAIN
162/19	TCDF	N/A	STACK	FG	TRAIN
162/19	P5CDF	N/A	STACK	FG	TRAIN

HAZARDOUS WASTE INCINERATOR

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
162/19	H6CDF	N/A	STACK	FG	TRAIN
162/19	H7CDF	N/A	STACK	FG	TRAIN
162/19	OCDF	N/A	STACK	FG	TRAIN
162/20	TCDD	540 ng/ml	STACK	FG	TRAIN
162/20	P5CDD	0 ng/ml	STACK	FG	TRAIN
162/20	H6CDD	0 ng/ml	STACK	FG	TRAIN
162/20	H7CDD	---	STACK	FG	TRAIN
162/20	OCDD	---	STACK	FG	TRAIN
162/20	TCDF	3200 ng/ml	STACK	FG	TRAIN
162/20	P5CDF	6100 ng/ml	STACK	FG	TRAIN
162/20	H6CDF	0 ng/ml	STACK	FG	TRAIN
162/20	H7CDF	---	STACK	FG	TRAIN
162/20	OCDF	---	STACK	FG	TRAIN
162/21	TCDD	650 ng/ml	STACK	FG	TRAIN
162/21	P5CDD	0 ng/ml	STACK	FG	TRAIN
162/21	H6CDD	90 ng/ml	STACK	FG	TRAIN
162/21	H7CDD	0 ng/ml	STACK	FG	TRAIN
162/21	OCDD	0 ng/ml	STACK	FG	TRAIN
162/21	TCDF	>24000 ng/ml	STACK	FG	TRAIN
162/21	P5CDF	>28000 ng/ml	STACK	FG	TRAIN
162/21	H6CDF	6500 ng/ml	STACK	FG	TRAIN
162/21	H7CDF	0 ng/ml	STACK	FG	TRAIN
162/21	OCDF	0 ng/ml	STACK	FG	TRAIN
162/22	TCDD	N/A	STACK	FG	TRAIN
162/22	P5CDD	N/A	STACK	FG	TRAIN
162/22	H6CDD	N/A	STACK	FG	TRAIN
162/22	H7CDD	N/A	STACK	FG	TRAIN
162/22	OCDD	N/A	STACK	FG	TRAIN
162/22	TCDF	N/A	STACK	FG	TRAIN
162/22	P5CDF	N/A	STACK	FG	TRAIN
162/22	H6CDF	N/A	STACK	FG	TRAIN
162/22	H7CDF	N/A	STACK	FG	TRAIN
162/22	OCDF	N/A	STACK	FG	TRAIN
194/1	2378-TCDD	<.005 ug/g	BAGHOUSE	ASH	GS
194/1	TCDD	.96 ug/g	BAGHOUSE	ASH	GS
194/1	P5CDD	1.4 ug/g	BAGHOUSE	ASH	GS
194/1	H6CDD	2.0 ug/g	BAGHOUSE	ASH	GS
194/1	H7CDD	.7 ug/g	BAGHOUSE	ASH	GS
194/1	OCDD	.2 ug/g	BAGHOUSE	ASH	GS
194/1	2378-TCDF	.1 ug/g	BAGHOUSE	ASH	GS
194/1	TCDF	.9 ug/g	BAGHOUSE	ASH	GS

HAZARDOUS WASTE INCINERATOR

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
194/1	P5CDF	1.5 ug/g	BAGHOUSE	ASH	GS
194/1	H6CDF	.15 ug/g	BAGHOUSE	ASH	GS
194/1	H7CDF	.06 ug/g	BAGHOUSE	ASH	GS
194/1	OCDF	.006 ug/g	BAGHOUSE	ASH	GS
194/1	2378-TCDD	<.001 ug/g	BOTTOM	ASH	GS
194/1	TCDD	.01 ug/g	BOTTOM	ASH	GS
194/1	P5CDD	.02 ug/g	BOTTOM	ASH	GS
194/1	H6CDD	.04ug/g	BOTTOM	ASH	GS
194/1	H7CDD	.10 ug/g	BOTTOM	ASH	GS
194/1	OCDD	.14 ug/g	BOTTOM	ASH	GS
194/1	2378-TCDF	ND	BOTTOM	ASH	GS
194/1	TCDF	ND	BOTTOM	ASH	GS
194/1	P5CDF	ND	BOTTOM	ASH	GS
194/1	H6CDF	ND	BOTTOM	ASH	GS
194/1	H7CDF	ND	BOTTOM	ASH	GS
194/1	OCDF	ND	BOTTOM	ASH	GS
194/2	TCDD	< 0.1 ng/g	XAD-2 (1)	PART	FILT.
194/2	P5CDD	< .05 ng/g	XAD-2 (1)	PART	FILT.
194/2	H6CDD	< 0.7 ng/g	XAD-2 (1)	PART	FILT.
194/2	H7CDD	< 0.1 ng/g	XAD-2 (1)	PART	FILT.
194/2	OCDD	< 0.2 ng/g	XAD-2 (1)	PART	FILT.
194/2	TCDF	< 0.1 ng/g	XAD-2 (1)	PART	FILT.
194/2	P5CDF	< .05 ng/g	XAD-2 (1)	PART	FILT.
194/2	H6CDF	< 0.7 ng/g	XAD-2 (1)	PART	FILT.
194/2	H7CDF	< 1.4 ng/g	XAD-2 (1)	PART	FILT.
194/2	OCDF	< 0.3 ng/g	XAD-2 (1)	PART	FILT.
194/2	TCDD	< .05 ng/g	XAD-2 (2)	PART	FILT.
194/2	P5CDD	< .05 ng/g	XAD-2 (2)	PART	FILT.
194/2	H6CDD	< 0.2 ng/g	XAD-2 (2)	PART	FILT.
194/2	H7CDD	< .05 ng/g	XAD-2 (2)	PART	FILT.
194/2	OCDD	< 0.1 ng/g	XAD-2 (2)	PART	FILT.
194/2	TCDF	< 0.2 ng/g	XAD-2 (2)	PART	FILT.
194/2	P5CDF	< .05 ng/g	XAD-2 (2)	PART	FILT.
194/2	H6CDF	< 0.3 ng/g	XAD-2 (2)	PART	FILT.
194/2	H7CDF	< 3.0 ng/g	XAD-2 (2)	PART	FILT.
194/2	OCDF	< 0.3 ng/g	XAD-2 (2)	PART	FILT.
234/R/1	TCDD	6.94 ng	Stack	FG	MM5T
234/R/2	TCDD	1.42 ng	Stack	FG	MM5T
234/R/3	TCDD	0 ng	Stack	FG	MM5T
234/R/1	TCDF	13.5 ng	Stack	FG	MM5T
234/R/2	TCDF	22 ng	Stack	FG	MM5T
234/R/3	TCDF	2 ng	Stack	FG	MM5T
234/E/1	TCDD	0.263 ng	Stack	FG	MM5T

HAZARDOUS WASTE INCINERATOR

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
234/E/2	TCDD	0.476 ng	Stack	FG	MM5T
234/E/3	TCDD	0 ng	Stack	FG	MM5T
234/E/1	TCDF	2 ng	Stack	FG	MM5T
234/E/2	TCDF	6 ng	Stack	FG	MM5T
234/E/3	TCDF	0 ng	Stack	FG	MM5T
*246	2,3,7,8 TCDD	ND	Stack	FG	MM5T
*246	P5CDD	40 ng	Stack	FG	MM5T

LIME/CEMENT KILNS

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
20A	PCDD	ND	STACK	FG	MM5T
20A	PCDF	ND	STACK	FG	MM5T
20B	PCDD	ND	STACK	FG	MM5T
20B	PCDF	ND	STACK	FG	MM5T
58A	PCDD	ND	BAGHOUSE	DUST	GS
58A	PCDD	ND	STACK	PART	FILTER
184	TCDD	ND	STACK	FG	SASS
184	P5CDD	ND	STACK	FG	SASS
184	H6CDD	ND	STACK	FG	SASS
184	H7CDD	ND	STACK	FG	SASS
184	OCDD	ND	STACK	FG	SASS
184	TCDF	ND	STACK	FG	SASS
184	P5CDF	ND	STACK	FG	SASS
184	H6CDF	1.35 ng/m3	STACK	FG	SASS
184	H7CDF	0.74 ng/m3	STACK	FG	SASS
184	OCDF	ND	STACK	FG	SASS
184	TCDD	ND	STACK	PART	FILTER
184	P5CDD	ND	STACK	PART	FILTER
184	H6CDD	ND	STACK	PART	FILTER
184	H7CDD	ND	STACK	PART	FILTER
184	OCDD	ND	STACK	PART	FILTER
184	TCDF	ND	STACK	PART	FILTER
184	P5CDF	11 ng/m3	STACK	PART	FILTER
184	H6CDF	25.7 ng/m3	STACK	PART	FILTER
184	H7CDF	8.1 ng/m3	STACK	PART	FILTER
184	OCDF	ND	STACK	PART	FILTER
184	TCDD	ND	BAGHOUSE	DUST	GS
184	P5CDD	ND	BAGHOUSE	DUST	GS
184	H6CDD	ND	BAGHOUSE	DUST	GS
184	H7CDD	ND	BAGHOUSE	DUST	GS
184	OCDD	ND	BAGHOUSE	DUST	GS
184	TCDF	ND	BAGHOUSE	DUST	GS
184	P5CDF	ND	BAGHOUSE	DUST	GS
184	H6CDF	ND	BAGHOUSE	DUST	GS
184	H7CDF	ND	BAGHOUSE	DUST	GS
184	OCDF	ND	BAGHOUSE	DUST	GS

HOSPITAL INCINERATORS

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
31A/2	TCDD	ND	STACK	FG	TRAIN
31A/2	P5CDD	22 ng/g	STACK	FG	TRAIN
31A/2	H6CDD	15.6 ng/g	STACK	FG	TRAIN
31A/2	H7CDD	19.2 ng/g	STACK	FG	TRAIN
31A/2	OCDD	26.8 ng/g	STACK	FG	TRAIN
31A/2	TCDF	18.9 ng/g	STACK	FG	TRAIN
31A/2	P5CDF	50.7 ng/g	STACK	FG	TRAIN
31A/2	H6CDF	57.5 ng/g	STACK	FG	TRAIN
31A/2	H7CDF	20.8 ng/g	STACK	FG	TRAIN
31A/2	OCDF	10.4 ng/g	STACK	FG	TRAIN
31A/3	TCDD	ND	STACK	FG	TRAIN
31A/3	P5CDD	28.6 ng/g	STACK	FG	TRAIN
31A/3	H6CDD	10.6 ng/g	STACK	FG	TRAIN
31A/3	H7CDD	18.9 ng/g	STACK	FG	TRAIN
31A/3	OCDD	25.4 ng/g	STACK	FG	TRAIN
31A/3	TCDF	34.9 ng/g	STACK	FG	TRAIN
31A/3	P5CDF	48.3 ng/g	STACK	FG	TRAIN
31A/3	H6CDF	35.7 ng/g	STACK	FG	TRAIN
31A/3	H7CDF	22 ng/g	STACK	FG	TRAIN
31A/3	OCDF	9.4 ng/g	STACK	FG	TRAIN
31A/4	TCDD	ND	STACK	FG	TRAIN
31A/4	P5CDD	4.1 ng/g	STACK	FG	TRAIN
31A/4	H6CDD	9.7 ng/g	STACK	FG	TRAIN
31A/4	H7CDD	11.4 ng/g	STACK	FG	TRAIN
31A/4	OCDD	26.7 ng/g	STACK	FG	TRAIN
31A/4	TCDF	22.5 ng/g	STACK	FG	TRAIN
31A/4	P5CDF	32.6 ng/g	STACK	FG	TRAIN
31A/4	H6CDF	29.8 ng/g	STACK	FG	TRAIN
31A/4	H7CDF	24.7 ng/g	STACK	FG	TRAIN
31A/4	OCDF	7.7 ng/g	STACK	FG	TRAIN
31A/5	TCDD	ND	STACK	FG	TRAIN
31A/5	P5CDD	8 ng/g	STACK	FG	TRAIN
31A/5	H6CDD	19.2 ng/g	STACK	FG	TRAIN
31A/5	H7CDD	17.4 ng/g	STACK	FG	TRAIN
31A/5	OCDD	12.4 ng/g	STACK	FG	TRAIN
31A/5	TCDF	31.6 ng/g	STACK	FG	TRAIN
31A/5	P5CDF	53.1 ng/g	STACK	FG	TRAIN
31A/5	H6CDF	48.7 ng/g	STACK	FG	TRAIN
31A/5	H7CDF	35.4 ng/g	STACK	FG	TRAIN
31A/5	OCDF	27.7 ng/g	STACK	FG	TRAIN
31A/A	TCDD	6.3 ng/g	DUCT WALL	FA	GS
31A/A	P5CDD	26.6 ng/g	DUCT WALL	FA	GS

HOSPITAL INCINERATORS

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
31A/A	H6CDD	87 ng/g	DUCT WALL	FA	GS
31A/A	H7CDD	45.6 ng/g	DUCT WALL	FA	GS
31A/A	OCDD	93.6 ng/g	DUCT WALL	FA	GS
31A/A	TCDF	32.9 ng/g	DUCT WALL	FA	GS
31A/A	P5CDF	70.1 ng/g	DUCT WALL	FA	GS
31A/A	H6CDF	61.8 ng/g	DUCT WALL	FA	GS
31A/A	H7CDF	96.2 ng/g	DUCT WALL	FA	GS
31A/A	OCDF	36.8 ng/g	DUCT WALL	FA	GS
31A/B	TCDD	125.8 ng/g	DUCT BOTTOM	FA	GS
31A/B	P5CDD	489.1 ng/g	DUCT BOTTOM	FA	GS
31A/B	H6CDD	933.8 ng/g	DUCT BOTTOM	FA	GS
31A/B	H7CDD	997.7 ng/g	DUCT BOTTOM	FA	GS
31A/B	OCDD	3931.5 ng/g	DUCT BOTTOM	FA	GS
31A/B	TCDF	937.5 ng/g	DUCT BOTTOM	FA	GS
31A/B	P5CDF	1599 ng/g	DUCT BOTTOM	FA	GS
31A/B	H6CDF	1732.8 ng/g	DUCT BOTTOM	FA	GS
31A/B	H7CDF	840.5 ng/g	DUCT BOTTOM	FA	GS
31A/B	OCDF	760.2 ng/g	DUCT BOTTOM	FA	GS
31A/C	TCDD	0.1 ng/g	COMB.CHAM.	ASH	GS
31A/C	P5CDD	0.2 ng/g	COMB.CHAM.	ASH	GS
31A/C	H6CDD	0.4 ng/g	COMB.CHAM.	ASH	GS
31A/C	H7CDD	0.4 ng/g	COMB.CHAM.	ASH	GS
31A/C	OCDD	0.5 ng/g	COMB.CHAM.	ASH	GS
31A/C	TCDF	1.0 ng/g	COMB.CHAM.	ASH	GS
31A/C	P5CDF	1.1 ng/g	COMB.CHAM.	ASH	GS
31A/C	H6CDF	0.7 ng/g	COMB.CHAM.	ASH	GS
31A/C	H7CDF	0.4 ng/g	COMB.CHAM.	ASH	GS
31A/C	OCDF	0.4 ng/g	COMB.CHAM.	ASH	GS
31A/D	TCDD	ND	COMB.CHAM.BOTTOM	ASH	GS
31A/D	P5CDD	ND	COMB.CHAM.BOTTOM	ASH	GS
31A/D	H6CDD	0.3 ng/g	COMB.CHAM.BOTTOM	ASH	GS
31A/D	H7CDD	0.5 ng/g	COMB.CHAM.BOTTOM	ASH	GS
31A/D	OCDD	1.9 ng/g	COMB.CHAM.BOTTOM	ASH	GS
31A/D	TCDF	0.7 ng/g	COMB.CHAM.BOTTOM	ASH	GS
31A/D	P5CDF	1.3 ng/g	COMB.CHAM.BOTTOM	ASH	GS
31A/D	H6CDF	3.0 ng/g	COMB.CHAM.BOTTOM	ASH	GS
31A/D	H7CDF	4.5 ng/g	COMB.CHAM.BOTTOM	ASH	GS
31A/D	OCDF	1.7 ng/g	COMB.CHAM.BOTTOM	ASH	GS
62A/US1	PCDD	11.8 ng/m3	STACK	PART.	FILTER
62A/US1	PCDF	18.9 ng/m3	STACK	PART.	FILTER
62A/US2	PCDD	28.2 ng/g	STACK	PART.	FILTER
62A/US2	PCDF	52.1 ng/g	STACK	PART.	FILTER

HOSPITAL INCINERATORS

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
62A/US3	PCDD	4.8 ng/g	STACK	PART.	FILTER
62A/US3	PCDF	4.8 ng/g	STACK	PART.	FILTER

WIRE RECLAMATION INCINERATOR

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
103	TCDD	410 ppt	Stack	FA	GS
103	TCDF	11600 ppt	Stack	FA	GS
103	TCDD	58 ppt	Furnace	FA	GS
103	TCDF	730 ppt	Furnace	FA	GS

PCB FIRES

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
158	TCDD	ND	N/A	Liquid	GS
158	TCDF	28.9 ppm	N/A	Soot	WIPES
158	2378-TCDF	6.3 ppm	N/A	Soot	
158	TCDD	0.324 ppm	N/A	Soot	WIPES
158	2,3,7,8 TCDD	0.059 ppm	N/A	Soot	WIPES
158	PCDD/PCDF	ND	N/A	Soot	WIPES
192/1/S	2,3,7,8 TCDF	20 ng/m2	In Fire	Soot	WIPES
192/1/S	TCDF	100 ng/m2	In Fire	Soot	WIPES
192/1/S	P5CDF	40 ng/m2	In Fire	Soot	WIPES
192/1/S	H6CDF	40 ng/m2	In Fire	Soot	WIPES
192/1/S	H7CDF	8 ng/m2	In Fire	Soot	WIPES
192/1/S	OCDF	5 ng/m2	In Fire	Soot	WIPES
192/1/S	2,3,7,8 TCDF	100 ng/m2	Near Fire	Soot	WIPES
192/1/S	TCDF	600 ng/m2	Near Fire	Soot	WIPES
192/1/S	P5CDF	100 ng/m2	Near Fire	Soot	WIPES
192/1/S	H6CDF	60 ng/m2	Near Fire	Soot	WIPES
192/1/S	H7CDF	8 ng/m2	Near Fire	Soot	WIPES
192/1/S	OCDF	5 ng/m2	Near Fire	Soot	WIPES
192/1/S	PCDD	ND	Wall(2m)	Soot	WIPES
192/1/S	PCDD	ND	Bench(10m)	Soot	WIPES
218	TCDD	ND	TRANSFORM.	ASH	GS
218	P5CDD	ND	TRANSFORM.	ASH	GS
218	H6CDD	ND	TRANSFORM.	ASH	GS
218	H7CDD	2.7 ng/g	TRANSFORM.	ASH	GS
218	OCDD	2.5 ng/g	TRANSFORM.	ASH	GS
218	TCDF	2.6 ng/g	TRANSFORM.	ASH	GS
218	P5CDF	16 ng/g	TRANSFORM.	ASH	GS
218	H6CDF	13 ng/g	TRANSFORM.	ASH	GS
218	H7CDF	6.4 ng/g	TRANSFORM.	ASH	GS
218	OCDF	3.4 ng/g	TRANSFORM.	ASH	GS

PCB FIRES

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
99/B1	OCDF	ND	FIRE	ASH	GS
99/B2	2378-TCDF	ND	FIRE	ASH	GS
99/B2	TCDF	ND	FIRE	ASH	GS
99/B2	P5CDF	ND	FIRE	ASH	GS
99/B2	H6CDF	ND	FIRE	ASH	GS
99/B2	H7CDF	ND	FIRE	ASH	GS
99/B2	OCDF	ND	FIRE	ASH	GS
99/B3	2378-TCDF	ND	FIRE	ASH	GS
99/B3	TCDF	ND	FIRE	ASH	GS
99/B3	P5CDF	ND	FIRE	ASH	GS
99/B3	H6CDF	ND	FIRE	ASH	GS
99/B3	H7CDF	ND	FIRE	ASH	GS
99/B3	OCDF	ND	FIRE	ASH	GS
99/B4	2378-TCDF	ND	FIRE	ASH	GS
99/B4	TCDF	ND	FIRE	ASH	GS
99/B4	P5CDF	ND	FIRE	ASH	GS
99/B4	H6CDF	ND	FIRE	ASH	GS
99/B4	H7CDF	ND	FIRE	ASH	GS
99/B4	OCDF	ND	FIRE	ASH	GS
99/B5	2378-TCDF	ND	FIRE	ASH	GS
99/B5	TCDF	ND	FIRE	ASH	GS
99/B5	P5CDF	ND	FIRE	ASH	GS
99/B5	H6CDF	ND	FIRE	ASH	GS
99/B5	H7CDF	ND	FIRE	ASH	GS
99/B5	OCDF	ND	FIRE	ASH	GS
99/B6	2378-TCDF	ND	FIRE	ASH	
99/B6	TCDF	280 ng/g	FIRE	ASH	GS
99/B6	P5CDF	290 ng/g	FIRE	ASH	GS
99/B6	H6CDF	100 ng/g	FIRE	ASH	GS
99/B6	H7CDF	ND	FIRE	ASH	GS
99/B6	OCDF	ND	FIRE	ASH	GS
110	PCDF	0.9-1.1 ppm	Intact Cap.	Liquid	GS
110	PCDF	75 ppm	In Exp Cap	Liquid	GS
110	PCDF	27-52 ppm	On Exp Cap	Liquid	Scraping
110	PCDF	<0.3 ppm	Fence	Ash	Scraping
110	PCDF	ND	Pine Need.	Ash	GS
158	TCDF	0.127 ppm	N/A	Liquid	GS

PCB FIRES

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
76/SUR	TCDF	90 ng/m2	S.E., FLOOR	Soot	WIPES
76/SUR	2378-TCDF	22 ng/m2	S.E., FLOOR	Soot	WIPES
76/SUR	P5CDF	25 ng/m2	S.E., FLOOR	Soot	WIPES
76/SUR	H6CDF	17 ng/m2	S.E., FLOOR	Soot	WIPES
76/SUR	H7CDF	17 ng/m2	S.E., FLOOR	Soot	WIPES
76/SUR	OCDF	4 ng/m2	S.E., FLOOR	Soot	WIPES
76/SUR	TCDF	<250 ng/m2	OUTSIDE(10m)	Soot	WIPES
76/SUR	2378-TCDF	<25 ng/m2	OUTSIDE(10m)	Soot	WIPES
76/SUR	P5CDF	<25 ng/m2	OUTSIDE(10m)	Soot	WIPES
76/SUR	H6CDF	<60 ng/m2	OUTSIDE(10m)	Soot	WIPES
76/SUR	H7CDF	58 ng/m2	OUTSIDE(10m)	Soot	WIPES
76/SUR	OCDF	17 ng/m2	OUTSIDE(10m)	Soot	WIPES
76/SUR	TCDF	<250 ng/m2	OUTSIDE(300m)	Soot	WIPES
76/SUR	2378-TCDF	<25 ng/m2	OUTSIDE(300m)	Soot	WIPES
76/SUR	P5CDF	<25 ng/m2	OUTSIDE(300m)	Soot	WIPES
76/SUR	H6CDF	<60 ng/m2	OUTSIDE(300m)	Soot	WIPES
76/SUR	H7CDF	<30 ng/m2	OUTSIDE(300m)	Soot	WIPES
76/SUR	OCDF	<12 ng/m2	OUTSIDE(300m)	Soot	WIPES
76/SUR	TCDF	<20 ng/m2	AFT.CLEANING(1)	Soot	WIPES
76/SUR	2378-TCDF	<4 ng/m2	AFT.CLEANING(1)	Soot	WIPES
76/SUR	P5CDF	<10 ng/m2	AFT.CLEANING(1)	Soot	WIPES
76/SUR	H6CDF	<12 ng/m2	AFT.CLEANING(1)	Soot	WIPES
76/SUR	H7CDF	<15 ng/m2	AFT.CLEANING(1)	Soot	WIPES
76/SUR	OCDF	2 ng/m2	AFT.CLEANING(1)	Soot	WIPES
76/SUR	TCDF	<40 ng/m2	AFT.CLEANING(2)	Soot	WIPES
76/SUR	2378-TCDF	<8 ng/m2	AFT.CLEANING(2)	Soot	WIPES
76/SUR	P5CDF	<20 ng/m2	AFT.CLEANING(2)	Soot	WIPES
76/SUR	H6CDF	<20 ng/m2	AFT.CLEANING(2)	Soot	WIPES
76/SUR	H7CDF	<30 ng/m2	AFT.CLEANING(2)	Soot	WIPES
76/SUR	OCDF	6 ng/m2	AFT.CLEANING(2)	Soot	WIPES
76/SKO	PCDF	.01 ug/m2	FOUNDRY	Soot	WIPES
76/SKO	PCDF	.8 ug/m2	BASEMENT CAPIC.	Soot	WIPES
98	TCDF	N/A	Capac/Wall	Liquid	
98	TCDD	N/A	Capac/Walls	Liquid	
98	2,3,7,8 TCDF	1.2 ng	Capacitor	Soot	
99/Bl	2378-TCDF	ND	FIRE	ASH	GS
99/Bl	TCDF	530 ng/g	FIRE	ASH	GS
99/Bl	P5CDF	1000 ng/g	FIRE	ASH	GS
99/Bl	H6CDF	180 ng/g	FIRE	ASH	GS
99/Bl	H7CDF	ND	FIRE	ASH	GS

PCB FIRES

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
60/BOST	2378-TCDF	3 ug/g	TRANSFORM.	SOOT	WIPES
60/BOST	TCDF	60 ug/g	TRANSFORM.	SOOT	WIPES
60/BOST	P5CDF	35 ug/g	TRANSFORM.	SOOT	WIPES
60/BOST	H6CDF	15 ug/g	TRANSFORM.	SOOT	WIPES
60/BOST	H7CDF	2 ug/g	TRANSFORM.	SOOT	WIPES
60/BOST	OCDF	ND	TRANSFORM.	SOOT	WIPES
60/BING	2378-TCDF	28 ug/g	TRANSFORM.	SOOT	WIPES
60/BING	TCDF	12 ug/g	TRANSFORM.	SOOT	WIPES
60/BING	P5CDF	670 ug/g	TRANSFORM.	SOOT	WIPES
60/BING	H6CDF	965 ug/g	TRANSFORM.	SOOT	WIPES
60/BING	H7CDF	460 ug/g	TRANSFORM.	SOOT	WIPES
60/BING	OCDF	40 ug/g	TRANSFORM.	SOOT	WIPES
76/SUR	TCDF	4000 ng/m2	Capicit. (1)	Soot	WIPES
76/SUR	2378-TCDF	875 ng/m2	Capicit. (1)	Soot	WIPES
76/SUR	P5CDF	3300 ng/m2	Capicit. (1)	Soot	WIPES
76/SUR	H6CDF	1800 ng/m2	Capicit. (1)	Soot	WIPES
76/SUR	H7CDF	1500 ng/m2	Capicit. (1)	Soot	WIPES
76/SUR	OCDF	300 ng/m2	Capicit. (1)	Soot	WIPES
76/SUR	TCDF	1100 ng/m2	Capicit. (2)	Soot	WIPES
76/SUR	2378-TCDF	365 ng/m2	Capicit. (2)	Soot	WIPES
76/SUR	P5CDF	1250 ng/m2	Capicit. (2)	Soot	WIPES
76/SUR	H6CDF	940 ng/m2	Capicit. (2)	Soot	WIPES
76/SUR	H7CDF	625 ng/m2	Capicit. (2)	Soot	WIPES
76/SUR	OCDF	145 ng/m2	Capicit. (2)	Soot	WIPES
76/SUR	TCDF	1250 ng/m2	N.E.CORNER(10m)	Soot	WIPES
76/SUR	2378-TCDF	300 ng/m2	N.E.CORNER(10m)	Soot	WIPES
76/SUR	P5CDF	355 ng/m2	N.E.CORNER(10m)	Soot	WIPES
76/SUR	H6CDF	150 ng/m2	N.E.CORNER(10m)	Soot	WIPES
76/SUR	H7CDF	65 ng/m2	N.E.CORNER(10m)	Soot	WIPES
76/SUR	OCDF	13 ng/m2	N.E.CORNER(10m)	Soot	WIPES
76/SUR	TCDF	480 ng/m2	S.E.CORNER(10m)	Soot	WIPES
76/SUR	2378-TCDF	120 ng/m2	S.E.CORNER(10m)	Soot	WIPES
76/SUR	P5CDF	210 ng/m2	S.E.CORNER(10m)	Soot	WIPES
76/SUR	H6CDF	140 ng/m2	S.E.CORNER(10m)	Soot	WIPES
76/SUR	H7CDF	60 ng/m2	S.E.CORNER(10m)	Soot	WIPES
76/SUR	OCDF	30 ng/m2	S.E.CORNER(10m)	Soot	WIPES
76/SUR	TCDF	100 ng/m2	N.E., FLOOR	Soot	WIPES
76/SUR	2378-TCDF	25 ng/m2	N.E., FLOOR	Soot	WIPES
76/SUR	P5CDF	27 ng/m2	N.E., FLOOR	Soot	WIPES
76/SUR	H6CDF	15 ng/m2	N.E., FLOOR	Soot	WIPES
76/SUR	H7CDF	5 ng/m2	N.E., FLOOR	Soot	WIPES
76/SUR	OCDF	2 ng/m2	N.E., FLOOR	Soot	WIPES

AUTOMOBILE EMISSIONS

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
62/1	2,3,7,8 TCDD	ND	MUFFLER	ASH	SCRAPING
62/1	TCDD	4.0 ppt	MUFFLER	ASH	SCRAPING
62/1	H6CDD	ND	MUFFLER	ASH	SCRAPING
62/1	H7CDD	ND	MUFFLER	ASH	SCRAPING
62/1	OCDD	16 ppt	MUFFLER	ASH	SCRAPING
62/2	2,3,7,8 TCDD	ND	MUFFLER	ASH	SCRAPING
62/2	TCDD	0.1 ppt	MUFFLER	ASH	SCRAPING
62/2	H6CDD	-	MUFFLER	ASH	SCRAPING
62/2	H7CDD	+	MUFFLER	ASH	SCRAPING
62/2	OCDD	+	MUFFLER	ASH	SCRAPING
62/5	2,3,7,8 TCDD	ND	MUFFLER	ASH	SCRAPING
62/5	TCDD	ND	MUFFLER	ASH	SCRAPING
62/5	H6CDD	ND	MUFFLER	ASH	SCRAPING
62/5	H7CDD	14 ppt	MUFFLER	ASH	SCRAPING
62/5	OCDD	68 ppt	MUFFLER	ASH	SCRAPING
62/6	2,3,7,8 TCDD	3.0 ppt	MUFFLER	ASH	SCRAPING
62/6	TCDD	20 ppt	MUFFLER	ASH	SCRAPING
62/6	H6CDD	20 ppt	MUFFLER	ASH	SCRAPING
62/6	H7CDD	100 ppt	MUFFLER	ASH	SCRAPING
62/6	OCDD	260 ppt	MUFFLER	ASH	SCRAPING
62/7	2,3,7,8 TCDD	ND	MUFFLER	ASH	SCRAPING
62/7	TCDD	ND	MUFFLER	ASH	SCRAPING
62/7	H6CDD	ND	MUFFLER	ASH	SCRAPING
62/7	H7CDD	110 ppt	MUFFLER	ASH	SCRAPING
62/7	OCDD	280 ppt	MUFFLER	ASH	SCRAPING
*213/W1	2,3,7,8 TCDD	ND	MUFFLER	FILTER	EXTRACT
*213/W1	TCDD	ND	MUFFLER	FILTER	EXTRACT
*213/W2	2,3,7,8 TCDD	2 ng	MUFFLER	FILTER	EXTRACT
*213/W2	TCDD	36 ng	MUFFLER	FILTER	EXTRACT
*213/W3	2,3,7,8 TCDD	0.23 ng	MUFFLER	FILTER	EXTRACT
*213/W3	TCDD	6.5 ng	MUFFLER	FILTER	EXTRACT
*213/W4	2,3,7,8 TCDD	0.15 ng	MUFFLER	FILTER	EXTRACT
*213/W4	TCDD	4.3 ng	MUFFLER	FILTER	EXTRACT

THERMAL ACTIVATED CARBON REGENERATION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
13/1	2378-TCDD	0.21 ng/dscm	STACK	FG	MM5T
13/1	TCDD	0.21 ng/dscm	STACK	FG	MM5T
13/1	2378-TCDF	0.24 ng/dscm	STACK	FG	MM5T
13/1	TCDF	0.51 ng/dscm	STACK	FG	MM5T
13/1	2378-TCDD	51.2 ng/g	STACK	PART.	MM5T
13/1	TCDD	51.2 ng/g	STACK	PART.	MM5T
13/1	2378-TCDF	58.0 ng/g	STACK	PART.	MM5T
13/1	TCDF	92.2 ng/g	STACK	PART.	MM5T
13/1	2378-TCDD	ND	CYCLONE	ASH	GS
13/1	TCDD	3.3 ppb	CYCLONE	ASH	GS
13/1	2378-TCDF	ND	CYCLONE	ASH	GS
13/1	TCDF	0.48	CYCLONE	ASH	GS
13/1	2378-TCDD	ND	-----	FEED	GS
13/1	TCDD	ND	-----	FEED	GS
13/1	2378-TCDF	ND	-----	FEED	GS
13/1	TCDF	ND	-----	FEED	GS
13/1	2378-TCDD	ND	SCRUBBER	WATER	GS
13/1	TCDD	ND	SCRUBBER	WATER	GS
13/1	2378-TCDF	ND	SCRUBBER	WATER	GS
13/1	TCDF	ND	SCRUBBER	WATER	GS
13/1	2378-TCDD	ND	QUENCH	WATER	GS
13/1	TCDD	ND	QUENCH	WATER	GS
13/1	2378-TCDF	ND	QUENCH	WATER	GS
13/1	TCDF	ND	QUENCH	WATER	GS
13/2	2378-TCDD	0.04 ng/dscm	STACK	FG	MM5T
13/2	TCDD	0.3 ng/dscm	STACK	FG	MM5T
13/2	2378-TCDF	ND	STACK	FG	MM5T
13/2	TCDF	0.08 ng/dscm	STACK	FG	MM5T
13/2	2378-TCDD	8.4 ng/g	STACK	PART.	MM5T
13/2	TCDD	65.9 ng/g	STACK	PART.	MM5T
13/2	2378-TCDF	ND	STACK	PART.	MM5T
13/2	TCDF	ND	STACK	PART.	MM5T
13/2	2378-TCDD	ND	CYCLONE	ASH	GS
13/2	TCDD	0.2 ppb	CYCLONE	ASH	GS
13/2	2378-TCDF	2.7 ppb	CYCLONE	ASH	GS
13/2	TCDF	3.3 ppb	CYCLONE	ASH	GS
13/2	2378-TCDD	ND	-----	FEED	GS
13/2	TCDD	ND	-----	FEED	GS
13/2	2378-TCDF	ND	-----	FEED	GS
13/2	TCDF	ND	-----	FEED	GS
13/2	2378-TCDD	0.07 ppb	SCRUBBER	WATER	GS
13/2	TCDD	0.2 ppb	SCRUBBER	WATER	GS
13/2	2378-TCDF	ND	SCRUBBER	WATER	GS
13/2	TCDF	ND	SCRUBBER	WATER	GS

THERMAL ACTIVATED CARBON REGENERATION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
13/2	2378-TCDD	ND	QUENCH	WATER	GS
13/2	TCDD	ND	QUENCH	WATER	GS
13/2	2378-TCDF	ND	QUENCH	WATER	GS
13/2	TCDF	ND	QUENCH	WATER	GS
13/3	2378-TCDD	0.01 ng/dscm	STACK	FG	MM5T
13/3	TCDD	0.06 ng/dscm	STACK	FG	MM5T
13/3	2378-TCDF	ND	STACK	FG	MM5T
13/3	TCDF	0.40 ng/dscm	STACK	FG	MM5T
13/3	2378-TCDD	4.3 ng/g	STACK	PART.	MM5T
13/3	TCDD	37.3 ng/g	STACK	PART.	MM5T
13/3	2378-TCDF	ND	STACK	PART.	MM5T
13/3	TCDF	245.3 ng/g	STACK	PART.	MM5T
13/3	2378-TCDD	0.01 ppb	CYCLONE	ASH	GS
13/3	TCDD	4.1 ppb	CYCLONE	ASH	GS
13/3	2378-TCDF	1.7 ppb	CYCLONE	ASH	GS
13/3	TCDF	2.1 ppb	CYCLONE	ASH	GS
13/3	2378-TCDD	ND	-----	FEED	GS
13/3	TCDD	ND	-----	FEED	GS
13/3	2378-TCDF	ND	-----	FEED	GS
13/3	TCDF	ND	-----	FEED	GS
13/3	2378-TCDD	0.06 ppb	SCRUBBER	WATER	GS
13/3	TCDD	0.1 ppb	SCRUBBER	WATER	GS
13/3	2378-TCDF	ND	SCRUBBER	WATER	GS
13/3	TCDF	ND	SCRUBBER	WATER	GS
13/3	2378-TCDD	ND	QUENCH	WATER	GS
13/3	TCDD	ND	QUENCH	WATER	GS
13/3	2378-TCDF	ND	QUENCH	WATER	GS
13/3	TCDF	ND	QUENCH	WATER	GS
13/4	2378-TCDD	0.13 ng/dscm	STACK	FG	MM5T
13/4	TCDD	0.13 ng/dscm	STACK	FG	MM5T
13/4	2378-TCDF	0.06 ng/dscm	STACK	FG	MM5T
13/4	TCDF	0.26 ng/dscm	STACK	FG	MM5T
13/4	2378-TCDD	35.5 ng/g	STACK	PART.	MM5T
13/4	TCDD	35.5 ng/g	STACK	PART.	MM5T
13/4	2378-TCDF	17.2 ng/g	STACK	PART.	MM5T
13/4	TCDF	72.3 ng/g	STACK	PART.	MM5T
13/4	2378-TCDD	ND	CYCLONE	ASH	GS
13/4	TCDD	1.3 ppb	CYCLONE	ASH	GS
13/4	2378-TCDF	0.6 ppb	CYCLONE	ASH	GS
13/4	TCDF	0.8 ppb	CYCLONE	ASH	GS
13/4	2378-TCDD	ND	-----	FEED	GS
13/4	TCDD	ND	-----	FEED	GS
13/4	2378-TCDF	ND	-----	FEED	GS
13/4	TCDF	ND	-----	FEED	GS

THERMAL ACTIVATED CARBON REGENERATION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
13/4	2378-TCDD	ND	SCRUBBER	WATER	GS
13/4	TCDD	ND	SCRUBBER	WATER	GS
13/4	2378-TCDF	ND	SCRUBBER	WATER	GS
13/4	TCDF	ND	SCRUBBER	WATER	GS
13/4	2378-TCDD	ND	QUENCH	WATER	GS
13/4	TCDD	ND	QUENCH	WATER	GS
13/4	2378-TCDF	ND	QUENCH	WATER	GS
13/4	TCDF	ND	QUENCH	WATER	GS
156/1	2378-TCDD	ND	RECUP.	PART.	MM5T
156/1	TCDD	ND	RECUP.	PART.	MM5T
156/1	P5CDD	ND	RECUP.	PART.	MM5T
156/1	H6CDD	ND	RECUP.	PART.	MM5T
156/1	H7CDD	ND	RECUP.	PART.	MM5T
156/1	OCDD	3.12 ng/dscm	RECUP.	PART.	MM5T
156/1	2378-TCDD	ND	RECUP.	FG	MM5T
156/1	TCDD	ND	RECUP.	FG	MM5T
156/1	P5CDD	ND	RECUP.	FG	MM5T
156/1	H6CDD	ND	RECUP.	FG	MM5T
156/1	H7CDD	.091 ng/dscm	RECUP.	FG	MM5T
156/1	OCDD	.50 ng/dscm	RECUP.	FG	MM5T
156/1	2378-TCDF	ND	RECUP.	PART.	MM5T
156/1	TCDF	.052 ng/dscm	RECUP.	PART.	MM5T
156/1	P5CDF	.044 ng/dscm	RECUP.	PART.	MM5T
156/1	H6CDF	ND	RECUP.	PART.	MM5T
156/1	H7CDF	ND	RECUP.	PART.	MM5T
156/1	OCDF	ND	RECUP.	PART.	MM5T
156/1	2378-TCDF	ND	RECUP.	FG	MM5T
156/1	TCDF	.094 ng/dscm	RECUP.	FG	MM5T
156/1	P5CDF	ND	RECUP.	FG	MM5T
156/1	H6CDF	.034 ng/dscm	RECUP.	FG	MM5T
156/1	H7CDF	.20 ng/dscm	RECUP.	FG	MM5T
156/1	OCDF	0.17 ng/dscm	RECUP.	FG	MM5T
156/2	2378-TCDD	ND	RECUP.	PART.	MM5T
156/2	TCDD	ND	RECUP.	PART.	MM5T
156/2	P5CDD	-	RECUP.	PART.	MM5T
156/2	H6CDD	-	RECUP.	PART.	MM5T
156/2	H7CDD	-	RECUP.	PART.	MM5T
156/2	OCDD	-	RECUP.	PART.	MM5T
156/2	2378-TCDD	ND	RECUP.	FG	MM5T
156/2	TCDD	ND	RECUP.	FG	MM5T
156/2	P5CDD	-	RECUP.	FG	MM5T
156/2	H6CDD	-	RECUP.	FG	MM5T
156/2	H7CDD	-	RECUP.	FG	MM5T

THERMAL ACTIVATED CARBON REGENERATION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
156/2	OCDD	-	RECUP.	FG	MM5T
156/2	2378-TCDF	ND	RECUP.	PART.	MM5T
156/2	TCDF	ND	RECUP.	PART.	MM5T
156/2	P5CDF	-	RECUP.	PART.	MM5T
156/2	H6CDF	-	RECUP.	PART.	MM5T
156/2	H7CDF	-	RECUP.	PART.	MM5T
156/2	OCDF	-	RECUP.	PART.	MM5T
156/2	2378-TCDF	ND	RECUP.	FG	MM5T
156/2	TCDF	.015 ng/dscm	RECUP.	FG	MM5T
156/2	P5CDF	-	RECUP.	FG	MM5T
156/2	H6CDF	-	RECUP.	FG	MM5T
156/2	H7CDF	-	RECUP.	FG	MM5T
156/2	OCDF	-	RECUP.	FG	MM5T
156/3	2378-TCDD	ND	AFTERBURN.	PART.	MM5T
156/3	TCDD	ND	AFTERBURN.	PART.	MM5T
156/3	P5CDD	-	AFTERBURN.	PART.	MM5T
156/3	H6CDD	-	AFTERBURN.	PART.	MM5T
156/3	H7CDD	-	AFTERBURN.	PART.	MM5T
156/3	OCDD	-	AFTERBURN.	PART.	MM5T
156/3	2378-TCDD	ND	AFTERBURN.	FG)	MM5T
156/3	TCDD	ND	AFTERBURN.	FG)	MM5T
156/3	P5CDD	-	AFTERBURN.	FG)	MM5T
156/3	H6CDD	-	AFTERBURN.	FG)	MM5T
156/3	H7CDD	-	AFTERBURN.	FG)	MM5T
156/3	OCDD	-	AFTERBURN.	FG)	MM5T
156/3	2378-TCDF	ND	AFTERBURN.	PART.	MM5T
156/3	TCDF	ND	AFTERBURN.	PART.	MM5T
156/3	P5CDF	-	AFTERBURN.	PART.	MM5T
156/3	H6CDF	-	AFTERBURN.	PART.	MM5T
156/3	H7CDF	-	AFTERBURN.	PART.	MM5T
156/3	OCDF	-	AFTERBURN.	PART.	MM5T
156/3	2378-TCDF	.015 ng/dscm	AFTERBURN.	FG)	MM5T
156/3	TCDF	.17 ng/dscm	AFTERBURN.	FG)	MM5T
156/3	P5CDF	-	AFTERBURN.	FG)	MM5T
156/3	H6CDF	-	AFTERBURN.	FG)	MM5T
156/3	H7CDF	-	AFTERBURN.	FG)	MM5T
156/3	OCDF	-	AFTERBURN.	FG)	MM5T
156/3	2378-TCDD	ND	STACK	PART.	MM5T
156/3	TCDD	ND	STACK	PART.	MM5T
156/3	P5CDD	-	STACK	PART.	MM5T
156/3	H6CDD	-	STACK	PART.	MM5T
156/3	H7CDD	-	STACK	PART.	MM5T
156/3	OCDD	-	STACK	PART.	MM5T
156/3	2378-TCDD	ND	STACK	FG	MM5T

THERMAL ACTIVATED CARBON REGENERATION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
156/3	TCDD	ND	STACK	FG	MM5T
156/3	P5CDD	-	STACK	FG	MM5T
156/3	H6CDD	-	STACK	FG	MM5T
156/3	H7CDD	-	STACK	FG	MM5T
156/3	OCDD	-	STACK	FG	MM5T
156/3	2378-TCDF	ND	STACK	PART.	MM5T
156/3	TCDF	ND	STACK	PART.	MM5T
156/3	P5CDF	-	STACK	PART.	MM5T
156/3	H6CDF	-	STACK	PART.	MM5T
156/3	H7CDF	-	STACK	PART.	MM5T
156/3	OCDF	-	STACK	PART.	MM5T
156/3	2378-TCDF	.018 ng/dscm	STACK	FG	MM5T
156/3	TCDF	.10 ng/dscm	STACK	FG	MM5T
156/3	P5CDF	-	STACK	FG	MM5T
156/3	H6CDF	-	STACK	FG	MM5T
156/3	H7CDF	-	STACK	FG	MM5T
156/3	OCDF	-	STACK	FG	MM5T
156/4	2378-TCDD	ND	AFTERBURN.	PART.	MM5T
156/4	TCDD	ND	AFTERBURN.	PART.	MM5T
156/4	P5CDD	-	AFTERBURN.	PART.	MM5T
156/4	H6CDD	-	AFTERBURN.	PART.	MM5T
156/4	H7CDD	-	AFTERBURN.	PART.	MM5T
156/4	OCDD	-	AFTERBURN.	PART.	MM5T
156/4	2378-TCDD	ND	AFTERBURN.	FG)	MM5T
156/4	TCDD	.012 ng/dscm	AFTERBURN.	FG)	MM5T
156/4	P5CDD	-	AFTERBURN.	FG)	MM5T
156/4	H6CDD	-	AFTERBURN.	FG)	MM5T
156/4	H7CDD	-	AFTERBURN.	FG)	MM5T
156/4	OCDD	-	AFTERBURN.	FG)	MM5T
156/4	2378-TCDF	ND	AFTERBURN.	PART.	MM5T
156/4	TCDF	ND	AFTERBURN.	PART.	MM5T
156/4	P5CDF	-	AFTERBURN.	PART.	MM5T
156/4	H6CDF	-	AFTERBURN.	PART.	MM5T
156/4	H7CDF	-	AFTERBURN.	PART.	MM5T
156/4	OCDF	-	AFTERBURN.	PART.	MM5T
156/4	2378-TCDF	.049 ng/dscm	AFTERBURN.	FG)	MM5T
156/4	TCDF	.39 ng/dscm	AFTERBURN.	FG)	MM5T
156/4	P5CDF	-	AFTERBURN.	FG)	MM5T
156/4	H6CDF	-	AFTERBURN.	FG)	MM5T
156/4	H7CDF	-	AFTERBURN.	FG)	MM5T
156/4	OCDF	-	AFTERBURN.	FG)	MM5T
156/5	2378-TCDD	ND	AFTERBURN.	PART.	MM5T
156/5	TCDD	ND	AFTERBURN.	PART.	MM5T
156/5	P5CDD	ND	AFTERBURN.	PART.	MM5T

THERMAL ACTIVATED CARBON REGENERATION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
156/5	H6CDD	ND	AFTERBURN.	PART.	MM5T
156/5	H7CDD	.27 ng/dscm	AFTERBURN.	PART.	MM5T
156/5	OCDD	.98 ng/dscm	AFTERBURN.	PART.	MM5T
156/5	2378-TCDD	ND	AFTERBURN.	FG)	MM5T
156/5	TCDD	ND	AFTERBURN.	FG)	MM5T
156/5	P5CDD	ND	AFTERBURN.	FG)	MM5T
156/5	H6CDD	ND	AFTERBURN.	FG)	MM5T
156/5	H7CDD	.024 ng/dscm	AFTERBURN.	FG)	MM5T
156/5	OCDD	.12 ng/dscm	AFTERBURN.	FG)	MM5T
156/5	2378-TCDF	ND	AFTERBURN.	PART.	MM5T
156/5	TCDF	ND	AFTERBURN.	PART.	MM5T
156/5	P5CDF	.015 ng/dscm	AFTERBURN.	PART.	MM5T
156/5	H6CDF	.035 ng/dscm	AFTERBURN.	PART.	MM5T
156/5	H7CDF	.073 ng/dscm	AFTERBURN.	PART.	MM5T
156/5	OCDF	.048 ng/dscm	AFTERBURN.	PART.	MM5T
156/5	2378-TCDF	.021 ng/dscm	AFTERBURN.	FG)	MM5T
156/5	TCDF	.098 ng/dscm	AFTERBURN.	FG)	MM5T
156/5	P5CDF	.044 ng/dscm	AFTERBURN.	FG)	MM5T
156/5	H6CDF	.029 ng/dscm	AFTERBURN.	FG)	MM5T
156/5	H7CDF	.018 ng/dscm	AFTERBURN.	FG)	MM5T
156/5	OCDF	.012 ng/dscm	AFTERBURN.	FG)	MM5T
156/5	2378-TCDD	ND	STACK	PART.	MM5T
156/5	TCDD	ND	STACK	PART.	MM5T
156/5	P5CDD	ND	STACK	PART.	MM5T
156/5	H6CDD	ND	STACK	PART.	MM5T
156/5	H7CDD	.17 ng/dscm	STACK	PART.	MM5T
156/5	OCDD	1.067 ng/dscm	STACK	PART.	MM5T
156/5	2378-TCDD	ND	STACK	FG	MM5T
156/5	TCDD	ND	STACK	FG	MM5T
156/5	P5CDD	ND	STACK	FG	MM5T
156/5	H6CDD	ND	STACK	FG	MM5T
156/5	H7CDD	.12ng/dscm	STACK	FG	MM5T
156/5	OCDD	.22 ng/dscm	STACK	FG	MM5T
156/5	2378-TCDF	ND	STACK	PART.	MM5T
156/5	TCDF	ND	STACK	PART.	MM5T
156/5	P5CDF	ND	STACK	PART.	MM5T
156/5	H6CDF	.0070 ng/dscm	STACK	PART.	MM5T
156/5	H7CDF	.021 ng/dscm	STACK	PART.	MM5T
156/5	OCDF	.018 ng/dscm	STACK	PART.	MM5T
156/5	2378-TCDF	ND	STACK	FG	MM5T
156/5	TCDF	ND	STACK	FG	MM5T
156/5	P5CDF	ND	STACK	FG	MM5T
156/5	H6CDF	ND	STACK	FG	MM5T
156/5	H7CDF	ND	STACK	FG	MM5T
156/5	OCDF	ND	STACK	FG	MM5T

THERMAL ACTIVATED CARBON REGENERATION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
156/6	2378-TCDD	ND	RECUP.	PART.	MM5T
156/6	TCDD	ND	RECUP.	PART.	MM5T
156/6	P5CDD	ND	RECUP.	PART.	MM5T
156/6	H6CDD	ND	RECUP.	PART.	MM5T
156/6	H7CDD	.23ng/dscm	RECUP.	PART.	MM5T
156/6	OCDD	1.38 ng/dscm	RECUP.	PART.	MM5T
156/6	2378-TCDD	ND	RECUP.	FG	MM5T
156/6	TCDD	.006 ng/dscm	RECUP.	FG	MM5T
156/6	P5CDD	.13 ng/dscm	RECUP.	FG	MM5T
156/6	H6CDD	.37 ng/dscm	RECUP.	FG	MM5T
156/6	H7CDD	.23 ng/dscm	RECUP.	FG	MM5T
156/6	OCDD	.23 ng/dscm	RECUP.	FG	MM5T
156/6	2378-TCDF	ND	RECUP.	PART.	MM5T
156/6	TCDF	ND	RECUP.	PART.	MM5T
156/6	P5CDF	.0070 ng/dscm	RECUP.	PART.	MM5T
156/6	H6CDF	ND	RECUP.	PART.	MM5T
156/6	H7CDF	ND	RECUP.	PART.	MM5T
156/6	OCDF	.37 ng/dscm	RECUP.	PART.	MM5T
156/6	2378-TCDF	.016 ng/dscm	RECUP.	FG	MM5T
156/6	TCDF	1.4 ng/dscm	RECUP.	FG	MM5T
156/6	P5CDF	1.1 ng/dscm	RECUP.	FG	MM5T
156/6	H6CDF	.76 ng/dscm	RECUP.	FG	MM5T
156/6	H7CDF	.76 ng/dscm	RECUP.	FG	MM5T
156/6	OCDF	.35 ng/dscm	RECUP.	FG	MM5T
156/7	2378-TCDD	ND	RECUP.	PART.	MM5T
156/7	TCDD	ND	RECUP.	PART.	MM5T
156/7	P5CDD	-	RECUP.	PART.	MM5T
156/7	H6CDD	-	RECUP.	PART.	MM5T
156/7	H7CDD	-	RECUP.	PART.	MM5T
156/7	OCDD	-	RECUP.	PART.	MM5T
156/7	2378-TCDD	ND	RECUP.	FG	MM5T
156/7	TCDD	.090 ng/dscm	RECUP.	FG	MM5T
156/7	P5CDD	-	RECUP.	FG	MM5T
156/7	H6CDD	-	RECUP.	FG	MM5T
156/7	H7CDD	-	RECUP.	FG	MM5T
156/7	OCDD	-	RECUP.	FG	MM5T
156/7	2378-TCDF	ND	RECUP.	PART.	MM5T
156/7	TCDF	.010 ng/dscm	RECUP.	PART.	MM5T
156/7	P5CDF	-	RECUP.	PART.	MM5T
156/7	H6CDF	-	RECUP.	PART.	MM5T
156/7	H7CDF	-	RECUP.	PART.	MM5T
156/7	OCDF	-	RECUP.	PART.	MM5T
156/7	2378-TCDF	ND	RECUP.	FG	MM5T
156/7	TCDF	.088 ng/dscm	RECUP.	FG	MM5T

THERMAL ACTIVATED CARBON REGENERATION

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
156/7	P5CDF	-	RECUP.	FG	MM5T
156/7	H6CDF	-	RECUP.	FG	MM5T
156/7	H7CDF	-	RECUP.	FG	MM5T
156/7	OCDF	-	RECUP.	FG	MM5T

EXPERIMENTAL

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
34	TCDD	84 ng/samp.	N/A	FG	N/A
34	TCDF	484 ng/samp.	N/A	FG	N/A
34	P5CDD	247 ng/samp.	N/A	FG	N/A
34	P5CDF	1710 ng/samp.	N/A	FG	N/A
34	H6CDD	370 ng/samp.	N/A	FG	N/A
34	H6CDF	1815 ng/samp.	N/A	FG	N/A
34	H7CDF	1105 ng/samp.	N/A	FG	N/A
34	H7CDD	240 ng/samp.	N/A	FG	N/A
34	OCDD	45 ng/samp.	N/A	FG	N/A
34	OCDF	295 ng/samp.	N/A	FG	N/A
36/A	TCDF	<0.02 %	N/A	FG	N/A
36/A	TCDF	0.25%	N/A	FG	N/A
36/A	TCDF	0.60 %	N/A	FG	N/A
36/A	TCDF	<0.02 %	N/A	FG	N/A
36/B	TCDF	0.35 %	N/A	FG	N/A
36/B	TCDF	<0.01 %	N/A	FG	N/A
36/B	TCDF	<0.01%	N/A	FG	N/A
36/B	TCDF	0.5%	N/A	FG	N/A
36/C	TCDF	0.3%	N/A	FG	N/A
36/C	TCDF	0.2%	N/A	FG	N/A
36/C	TCDF	1.6 %	N/A	FG	N/A
36/C	TCDF	<0.1%	N/A	FG	N/A
36/C	TCDF	<0.1%	N/A	FG	N/A
37	PCDF	0.1% - several %	N/A	FG	N/A
62	H7CDD	8.5, 9.0 pg/cigarett	N/A	SMOKE	FILTER
62	OCDD	50, 18 pg/cigarette	N/A	SMOKE	FILTER
62	TCDD	ND	N/A	SMOKE	FILTER
62	H6CDD	8.0, 4.2 pg/cigarett	N/A	SMOKE	FILTER
111/A	TCDD	70 ug/g	N/A	FG	GLASS WOOL
111/A	P5CDD	35 ug/g	N/A	FG	GLASS WOOL
111/A	H6CDD	4 ug/g	N/A	FG	GLASS WOOL
111/A	H7CDD	2.4 ug/g	N/A	FG	GLASS WOOL
111/A	OCDD	2 ug/g	N/A	FG	GLASS WOOL
111/B	TCDD	53 ug/g	N/A	FG	GLASS WOOL
111/B	P5CDD	98 ug/g	N/A	FG	GLASS WOOL
111/B	H6CDD	155 ug/g	N/A	FG	GLASS WOOL
111/B	H7CDD	46 ug/g	N/A	FG	GLASS WOOL
111/B	OCDD	3.5 ug/g	N/A	FG	GLASS WOOL
111/C	TCDD	0.6 ug/g	N/A	FG	GLASS WOOL
111/C	P5CDD	0.4 ug/g	N/A	FG	GLASS WOOL
111/C	H6CDD	0.8 ug/g	N/A	FG	GLASS WOOL

EXPERIMENTAL

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
111/C	H7CDD	0.4 ug/g	N/A	FG	GLASS WOOL
111/C	OCDD	0.7 ug/g	N/A	FG	GLASS WOOL
111/D	TCDD	o.2 ug/g	N/A	FG	GLASS WOOL
111/D	P5CDD	4 ug/g	N/A	FG	GLASS WOOL
111/D	H6CDD	1.6 ug/g	N/A	FG	GLASS WOOL
111/D	H7CDD	4.6 ug/g	N/A	FG	GLASS WOOL
111/D	OCDD	5.2 ug/g	N/A	FG	GLASS WOOL
145/A	TCDD	TRACE	N/A	FG	N/A
145/A	P5CDD	101 ug/g	N/A	FG	N/A
145/A	H6CDD	90 ug/g	N/A	FG	N/A
145/A	H7CDD	28 ug/g	N/A	FG	N/A
145/A	OCDD	80 ug/g	N/A	FG	N/A
145/A	TCDF	TRACE	N/A	FG	N/A
145/A	P5CDF	TRACE	N/A	FG	N/A
145/A	H6CDF	TRACE	N/A	FG	N/A
145/A	H7CDF	28 ug/g	N/A	FG	N/A
145/A	OCDF	38 ug/g	N/A	FG	N/A
145/B	TCDD	TRACE	N/A	FG	N/A
145/B	P5CDD	62 ug/g	N/A	FG	N/A
145/B	H6CDD	2 ug/g	N/A	FG	N/A
145/B	H7CDD	6 ug/g	N/A	FG	N/A
145/B	OCDD	25 ug/g	N/A	FG	N/A
145/B	TCDF	TRACE	N/A	FG	N/A
145/B	P5CDF	TRACE	N/A	FG	N/A
145/B	H6CDF	TRACE	N/A	FG	N/A
145/B	H7CDF	10 ug/g	N/A	FG	N/A
145/B	OCDF	6 ug/g	N/A	FG	N/A
145/C	TCDD	47 ug/g	N/A	FG	N/A
145/C	P5CDD	40 ug/g	N/A	FG	N/A
145/C	H6CDD	44 ug/g	N/A	FG	N/A
145/C	H7CDD	15 ug/g	N/A	FG	N/A
145/C	OCDD	N/A	N/A	FG	N/A
145/C	TCDF	74 ug/g	N/A	FG	N/A
145/C	P5CDF	62 ug/g	N/A	FG	N/A
145/C	H6CDF	16 ug/g	N/A	FG	N/A
145/C	H7CDF	15 ug/g	N/A	FG	N/A
145/C	OCDF	N/A	N/A	FG	N/A
146	PCDD/PCDF	N/A	N/A	FG	N/A
149/1	TCDD	ND	N/A	Feed	Wool Trap
149/1	H6CDD	ND	N/A	Feed	Wool Trap
149/1	H7CDD	ND	N/A	Feed	Wool Trap
149/1	OCDD	ND	N/A	Feed	Wool Trap
149/2	TCDD	ND	N/A	Feed	Wool Trap

EXPERIMENTAL

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
149/2	H6CDD	ND	N/A	Feed	Wool Trap
149/2	H7CDD	ND	N/A	Feed	Wool Trap
149/2	OCDD	ND	N/A	Feed	Wool Trap
149/3	TCDD	ND	N/A	FG	Wool Trap
149/3	H6CDD	ND	N/A	FG	Wool Trap
149/3	H7CDD	ND	N/A	FG	Wool Trap
149/3	OCDD	ND	N/A	FG	Wool Trap
149/4	TCDD	ND	N/A	FG	Wool Trap
149/4	H6CDD	ND	N/A	FG	Wool Trap
149/4	H7CDD	0.6 ng/g feed	N/A	FG	Wool Trap
149/4	OCDD	1.3 ng/g feed	N/A	FG	Wool Trap
149/5	TCDD	ND	N/A	FG	Wool Trap
149/5	H6CDD	ND	N/A	FG	Wool Trap
149/5	H7CDD	0.5 ng/g feed	N/A	FG	Wool Trap
149/5	OCDD	2.7 ng/g feed	N/A	FG	Wool Trap
149/6	TCDD	1.4 ng/g feed	N/A	FG	Wool Trap
149/6	H6CDD	8.4 ng/g feed	N/A	FG	Wool Trap
149/6	H7CDD	25 ng/g feed	N/A	FG	Wool Trap
149/6	OCDD	64 ng/g geed	N/A	FG	Wool Trap
149/7	TCDD	1.2 ng/g feed	N/A	FG	Wool Trap
149/7	H6CDD	29 ng/g feed	N/A	FG	Wool Trap
149/7	H7CDD	91 ng/g feed	N/A	FG	Wool Trap
149/7	OCDD	290 ng/g feed	N/A	FG	Wool Trap
200/A	T4CDD/T4CDF	95 mg/kg	LAB FURN	FG	METH. TRAP
200/A	P5CDD/P5CDF	108 mg/kg	LAB FURN	FG	METH. TRAP
200/A	H6CDD/H6CDF	146 mg/kg	LAB FURN	FG	METH. TRAP
200/A	H7CDD/H7CDF	52 mg/kg	LAB FURN	FG	METH. TRAP
200/A	OCDD/OCDF	14 mg/kg	LAB FURN	FG	METH. TRAP
200/A	T4CDD/T4CDF	N/A	LAB FURN	FG	METH. TRAP
200/A	P5CDD/P5CDF	65 mg/kg	LAB FURN	FG	METH. TRAP
200/A	H6CDD/H6CDF	153 mg/kg	LAB FURN	FG	METH. TRAP
200/A	H7CDD/H7CDF	74 mg/kg	LAB FURN	FG	METH. TRAP
200/A	OCDD/OCDF	27 mg/kg	LAB FURN	FG	METH. TRAP
200/B	T4CDD/T4CDF	60 mg/kg	LAB FURN	FG	METH. TRAP
200/B	P5CDD/P5CDF	400 mg/kg	LAB FURN	FG	METH. TRAP
200/B	H6CDD/H6CDF	2500 mg/kg	LAB FURN	FG	METH. TRAP
200/B	H7CDD/H7CDF	1500 mg/kg	LAB FURN	FG	METH. TRAP
200/B	OCDD/OCDF	250 mg/kg	LAB FURN	FG	METH. TRAP
200/B	T4CDD/T4CDF	4 mg/kg	LAB FURN	FG	METH. TRAP
200/B	P5CDD/P5CDF	20 mg/kg	LAB FURN	FG	METH. TRAP
200/B	H6CDD/H6CDF	100 mg/kg	LAB FURN	FG	METH. TRAP

EXPERIMENTAL

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
200/B	H7CDD/H7CDF	105 mg/kg	LAB FURN	FG	METH. TRAP
200/B	OCDD/OCDF	20 mg/kg	LAB FURN	FG	METH. TRAP
200/B	T4CDD/T4CDF	0.6 mg/kg	LAB FURN	FG	METH. TRAP
200/B	P5CDD/P5CDF	3.5 mg/kg	LAB FURN	FG	METH. TRAP
200/B	H6CDD/H6CDF	40 mg/kg	LAB FURN	FG	METH. TRAP
200/B	H7CDD/H7CDF	75 mg/kg	LAB FURN	FG	METH. TRAP
200/B	OCDD/OCDF	15 mg/kg	LAB FURN	FG	METH. TRAP
200/C	T4CDD/T4CDF	60 mg/kg	LAB FURN	FG	METH. TRAP
200/C	P5CDD/P5CDF	650 mg/kg	LAB FURN	FG	METH. TRAP
200/C	H6CDD/H6CDF	3300 mg/kg	LAB FURN	FG	METH. TRAP
200/C	H7CDD/H7CDF	3400 mg/kg	LAB FURN	FG	METH. TRAP
200/C	OCDD/OCDF	60 mg/kg	LAB FURN	FG	METH. TRAP
200/C	T4CDD/T4CDF	39 mg/kg	LAB FURN	FG	METH. TRAP
200/C	P5CDD/P5CDF	47 mg/kg	LAB FURN	FG	METH. TRAP
200/C	H6CDD/H6CDF	450 mg/kg	LAB FURN	FG	METH. TRAP
200/C	H7CDD/H7CDF	200 mg/kg	LAB FURN	FG	METH. TRAP
200/C	OCDD/OCDF	35 mg/kg	LAB FURN	FG	METH. TRAP
200/C	T4CDD/T4CDF	2 mg/kg	LAB FURN	FG	METH. TRAP
200/C	P5CDD/P5CDF	2 mg/kg	LAB FURN	FG	METH. TRAP
200/C	H6CDD/H6CDF	150 mg/kg	LAB FURN	FG	METH. TRAP
200/C	H7CDD/H7CDF	130 mg/kg	LAB FURN	FG	METH. TRAP
200/C	OCDD/OCDF	25 mg/kg	LAB FURN	FG	METH. TRAP
200/D	T4CDD/T4CDF	50 mg/kg	LAB FURN	FG	METH. TRAP
200/D	P5CDD/P5CDF	85 mg/kg	LAB FURN	FG	METH. TRAP
200/D	H6CDD/H6CDF	*220 mg/kg	LAB FURN	FG	METH. TRAP
200/D	H7CDD/H7CDF	230 mg/kg	LAB FURN	FG	METH. TRAP
200/D	OCDD/OCDF	45 mg/kg	LAB FURN	FG	METH. TRAP
200/D	T4CDD/T4CDF	1.4 mg/kg	LAB FURN	FG	METH. TRAP
200/D	P5CDD/P5CDF	3.9 mg/kg	LAB FURN	FG	METH. TRAP
200/D	H6CDD/H6CDF	20 mg/kg	LAB FURN	FG	METH. TRAP
200/D	H7CDD/H7CDF	15 mg/kg	LAB FURN	FG	METH. TRAP
200/D	OCDD/OCDF	2.1 mg/kg	LAB FURN	FG	METH. TRAP
219	2,3,7,8 TCDD	0.375 ug/g TCP	N/A	FG	Gas Adsorp.
226	PCDD/PCDF	ND	N/A	FG	XAD-2 Trap
226	TCDD	21 ng/g wood	N/A	FG	XAD-2 Trap

EXPERIMENTAL

REF #	ISOMER	ISOMER CONC.	PROCESSES	SAMPLE	METHOD
226	2,3,7,8 TCDD	0.6 ng/g wood	N/A	FG	XAD-2 Trap

APPENDIX C

DATA BASE REFERENCE TABLES

APPENDIX C

DATA BASE REFERENCE TABLES

Municipal Waste Combustors. C-2

Sewage Sludge Incinerators. C-11

Fossil Fuel Combustion. C-12

Wood Combustion C-14

Boilers Cofiring Wastes C-17

Hazardous Waste Incinerators. C-20

Lime/Cement Kilns C-24

Hospital Incinerators C-25

Wire Reclamation Incinerator. C-26

PCB Fires C-27

Automobile Emissions. C-29

Thermal Activated Carbon Regeneration C-30

Experimental. C-31

The following information is further background information regarding the dioxin concentration data contained in Appendix B.

MUNICIPAL WASTE COMBUSTORS

Reference #12

Facility Location: West Germany MIP, West Germany Power Plant
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: N/A
Extraction: Toluene/Methanol
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: University of Ulm, Germany

Reference #25

Facility Location: Florence
Incinerator Characteristic: 3 simultaneously operating furnaces: feed capacity 450 tons/day. Operation under isokinetic conditions.
Sampling Schedule/# of Samples: 3 Fume Samples;
1 Precipitated Fly Ash Sample
Extraction: Continuously extracted by Soxhlet/Toluene
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: Instituto Inguinamento Atmosferico 1 Rome
Laboratorio Provinciale Igiene e Profilassi/Milan /Firenze

Reference #26

Facility Location: Europe
Incinerator Characteristic:
5 tests using Inc. after compost production
5 tests using Inc. without any treatment
5 tests using Inc. after recycling
Sampling Schedule/# of Samples: N/A
Extraction: Toluene/Methanol
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: Instituto Inguinamento Atmosferico 1 Rome, CNR

Reference #32

Facility Location: Albany, NY
Incinerator Characteristic: Natural Gas Supplemental Fuel 600 tons/day, Temp. - 390°F
Sampling Schedule/# of Samples: 3 tests/48 hours
Extraction: Soxhlet
Analysis Technique: GC/HRMS
Precursors Present: MSW
Sampling Organization: N/A

Reference #33

Facility Location: Zurich, Switzerland
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: N/A
Extraction: Methylene Chloride
Analysis Technique: GC/MS
Precursors Present: Mun. & Ind. S.W.
Sampling Organization: Swiss Federal Research Station

Reference #43

Facility location: Italy
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: N/A
Extraction: Hexane
Analysis Technique: HRGC/MS
Precursors Present: MSW
Sampling Organization: Lab. Prov. di Igiene e Prof.

Reference #44

Facility Location: N/A
Incinerator Characteristic: Modern heat recovery incinerator
Modular controlled air incinerator
Sampling Schedule/# of Samples: N/A
Extraction: Hexane
Analysis Technique: HRGC/LRMS
Precursors Present: MSW, PCP treated wood, PCB, Coal
Sampling Organization: Laboratory Services Division, Environment Canada

Reference #47

Facility Location: Ontario
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: 7
Extraction: Soxhlet (16 hr.)
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: Ministry of The Environment, Ontario, Canada

Reference #49

Facility Location: Charlottetown, Ontario
Incinerator Characteristic: 3 tests (PT2-PT4) done under normal conditions; 3 tests (PT5-7) done under Long Cycle; 3 tests (PT8-10) done under high temp; 3 tests (PT11-13) done under low temp.
Sampling Schedule/# of Samples: N/A
Extraction: N/A
Analysis Technique: N/A
Precursors Present: MSW
Sampling Organization: Concord Scientific Corporation

Reference #51

Facility Location: Tsushima, Japan
Incinerator Characteristic: Dry scrubbing and Fabric filter system
Reverse Reciprocating Grate Incinerators
Sampling Schedule/# of Samples: 4 sample points
Extraction: N/A
Analysis Technique: N/A
Precursors Present: MSW
Sampling Organizaiton: Ministry of the Environment, Ontario, Canada
California Air Resource Board, USA

Reference #69

Facility Location: Ontario, Canada
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: 8 weeks/3 rep.
Extraction: Soxhlet/Benzene (16 hour)
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: Ministry of the Environment, Ontario, Canada

Reference #70

Facility Location: Ontario, Canada
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: 5 replications
Extraction: Ultrasonic/Benzene (1 hr)
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: Ministry of the Environment, Ontario, Canada

Reference #71

Facility Location: 1 & 2/Japan, 3/Netherlands, 4 & 5/Ontario
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: 1 sample
Extraction: Soxhlet/Benzene
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: 1 & 2/University of Kyoto
3/University of Amsterdam
4 & 5/Ministry of the Environment, Ontario, Canada

Reference #87

Facility location: Como, Italy
Incinerator Characteristic: >500 degrees C
Sampling Schedule/# of Samples: 17 samples/9 months
Extraction: Hexane
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: Institute for Pharmacological Research
Milan, Italy

Reference #90

Facility Location: Municipal Incinerator/U.S.A.
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: 1 sample
Extraction: N/A
Analysis Technique: GC/HRMS
Precursors Present: MSW
Sampling Organization: University of Nebraska

Reference #92

Facility Location: Hampton, VA, U.S.A.
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: N/A
Extraction: N/A
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: Midwest Research Institute

Reference #97

Facility Location: U.S.A.
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: 5 samples
Extraction: N/A
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: U.S. EPA

Reference #100

Facility location: U.S.A. Facilities
Incinerator Characteristic: 1 Industrial Spreader Stoker
1 Incinerator/Boiler
1 Small Modular
Sampling Schedule/# of Samples: 2-4 days
Extraction: Hexane/KOH
Analysis Technique: GC/HRMS
Precursors Present: 6 samples using MSW/Waste Oil
3 samples using RDF
4 samples using Processed MSW
Sampling Organization: Systech Corporation

Reference #101

Facility Location: U.S.A.
Incinerator Characteristic: 1 RDF; 1 Mass Burning;
1 Modular (30% Industrial Feed)
Sampling Schedule/# of Samples: 3 tests/unit
Extraction: Soxhlet/Methylene Chloride
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: Battelle-Columbus Laboratories

Reference #109

Facility location: Beveren, Belgium
Incinerator Characteristic: Domestic/Industrial Wastes
Sampling Schedule/# of Samples: 12 test
Extraction: N/A
Analysis Technique: GC/MS
Precursors Present: PCB's, PCP's
Sampling Organization: University of Antwerp

Reference #115

Facility Location: N/A
Incinerator Characteristic: One plant
Sampling Schedule/# of Samples: 3-8 samples
Extraction: Soxhlet/Methylene Chloride
Analysis Technique: GC/MS
Precursors Present: MSW/Coal
Sampling Organization: Ames Lab, Iowa State University

Reference #116

Facility Location: France
Incinerator Characteristic: 950 degrees C
Sampling Schedule/# of Samples: 1 sample
Extraction: Ultrasonic/Benzene
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: University of Waterloo, Ontario

Reference #118

Facility Location: TIRU, Paris, France
Incinerator Characteristic: Feed Rate = 16 tons/hr Energy Recovery
Sampling Schedule/# of Samples: 2 sets of 3 samples
Incineration without treatment,
Incineration with spiked PVC
Extraction: Soxhlet/Benzene
Analysis Technique: GC/MS
Precursors Present: Test 1, MSW; Test 2, MSW & PVC
Sampling Organization: Electricite de France--Traitement Industriel des Residus Urbains (EDF-TIRU)

Reference #143

Facility Location: Urban Incinerator/Italy
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: 1 sample
Extraction: Soxhlet/Benzene
Analysis Technique: GC/MS
Precursors Present: MSW/PCB
Sampling Organization: Instituto Inguinamento Atmosferico, Rome

Reference #144

Facility Location: Bologna, Italy
Florence, Italy
Milano, Italy
Incinerator Characteristic: 3 Urban Incinerators
2 Rural Incinerators
1 Recycled Waste
2 Incinerators burning waste residue
Sampling Schedule/# of Samples: N/A
Extraction: Soxhlet/Xylene
Analysis Technique: GC/MS
Precursors Present: Urban/Untreated MSW
Rural/Ag Products
N/A's/Homogenized or processed MSW
Sampling Organization: Instituto Inguinamento Atmosferico, Rome

Reference #160

Facility Location: Hampton, VA, U.S.A.
Incinerator Characteristic: Refuse Incinerator-Raw Municipal Waste
Sampling Schedule/# of Samples: 5 days: 2-6/day
Extraction: Soxhlet/Benzene
Analysis Technique: HRGC/MS
Precursors Present: MSW
Sampling Organization: Midwest Research Institute

Reference #168

Facility Location: City of Philadelphia, Northwest Units 1 & 2
Pennsylvania, U.S.A.
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: 16 Bottom ash; 16 Fly Ash; 15 Flue Gas
Extraction: Soxhlet/Benzene
Analysis Technique: HRGC/MS
Precursors Present: MSW
Sampling Organization: Midwest Research Institute

Reference #174

Facility Location: Hampton, VA., U.S.A.

Incinerator Characteristic: 1 Converted Coal Boiler
1 Incinerator-Boiler

Sampling Schedule/# of Samples: Coal Boilers, 3 tests/2 days
Incin.-Boilers, 3 tests/4 days

Extraction: Methanol/Hexane

Analysis Technique: GC/MS

Precursors Present: Coal Boilers/RDF
Incin.-Boilers/Refuse

Sampling Organization: Scott Environmental Services

Reference #178

Facility location: Alkamaar, Netherlands
Amsterdam, Netherlands
Arnhem, Netherlands
Leewarden, Netherlands
Leiden, Netherlands
Rijnmond, Netherlands
Roosendaal, Netherlands
Rotterdam, Netherlands
Zaanstad, Netherlands

Incinerator Characteristic: N/A

Sampling Schedule/# of Samples:
Alkamaar: 17 samples/1.5 years
Amsterdam: 14 samples/1.5 years
Arnhem, Leewarden, Leiden, Rijnmond, Roosendaal & Rotterdam: 5 months
Zaanstad: 6 tested at 23 samples/1.5 years
10 tested at 10/2 hours
10 tested at 14 samples/1.5 years

Extraction: Soxhlet/Toluene (24 hr)

Analysis Technique: GC/MS

Precursors Present: MSW

Sampling Organization: University of Amsterdam

Reference #181

Facility Location: SWARA Plant, Canada

Incinerator Characteristic: Traveling Grate Boiler

Sampling Schedule/# of Samples: 15 runs

Extraction: N/A

Analysis Technique: GC/MS

Precursors Present: RDF

Sampling Organization: Ontario Research Foundation

Reference #196

Facility Location: Chicago NW and Ames, Iowa, U.S.A.
Incinerator Characteristic: 1 Coal/RDF (1200°C)
1 Raw Municipal Waste (650°C)
Sampling Schedule/# of Samples: Coal/RDF 1:10 days
Municipal 1:9 days
Extraction: Soxhlet
Analysis Technique: HRGC/MS
Precursors Present: Raw MSW, 85% Coal/15% RDF
Sampling Organization: TRW, Inc.

Reference #202

Facility Location: Sincin. (North America)
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: 5 samples
Extraction: Soxhlet
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: Texas A & M University
College of Veterinary Medicine

Reference #203

Facility Location: North America
Incinerator Characteristic: Municipal Incinerator
Sampling Schedule/# of Samples: Fly ash sample/$3m^3$ of gaseous material
Extraction: Soxhlet
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: Texas A&M; University of Amsterdam

Reference #205

Facility Location: Hampton, VA, U.S.A.
Incinerator Characteristic: Steamflow - 27,500 lb/hr
Furnace temp. - 1500°F
Sampling Schedule/# of Samples: 240 min/3 tests
Extraction: Hexane/Toluene
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: Wright State University

Reference #221

Facility Location: KVA, Zurich-Josefstrasse
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: N/A
Extraction: N/A
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: Dubendorf, Switzerland F. M. I. and E. I.

Reference #222

Facility Location: N/A
Incinerator Characteristic: Boiler
Sampling Schedule/# of Samples: Tests 3 = 3 hours
Extraction: Soxhlet/Benzene
Analysis Technique: GC/MS
Precursors Present: RDF
Sampling Organization: Scott Environmental Technology

Reference #225

Facility Location: Philadelphia Northwest Incinerator, U.S.A.
Incinerator Characteristic: Crane and bin type; two Tynan trash furnaces; maximum temperature 2100°F. Average 1500°F during test.
Sampling Schedule/# of Samples: ESP hopper ash samples; single sample from each furnace for two days.
Extraction: Soxhlet/benzene
Analysis Technique: GC/MS
Precursors Present: MSW
Sampling Organization: Engineering-Science

Reference #228

Facility Location: Hempstead, Long Island, U.S.A.
Incinerator Characteristic: RDF/Energy Recovery
Sampling Schedule/# of Samples: 11
Extraction: Methylene Chloride
Analysis Technique: GC/HRMS
Precursors Present: RDF/Biocide
Sampling Organization: Wright State University

Reference #243

Facility Location: Utility Plant
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: N/A
Extraction: Soxhlet
Analysis Technique: GC/MS
Precursors Present: MSW/Coal
Sampling Organization: U.S. Department of Energy

SEWAGE SLUDGE INCINERATORS

Reference #24

Facility Location: N/A
Incinerator Characteristic: Sludge Incineration
Sampling Schedule/# of Samples: 6 samples
Extraction: Soxhlet/Hexane, dichloromethane, acetone (80:15:5)
Analysis Technique: GC
Precursors Present: Sewage Sludge
Sampling Organization: N/A

Reference #235

Facility Location: Ontario
Incinerator Characteristic: Multiple Hearth Inc. (1000°C). Feed rate 13 to 15.5 short tons/hr.
Sampling Schedule/# of Samples: 3 sample periods
Extraction: N/A
Analysis Technique: N/A
Precursors Present: Sewage Sludge
Sampling Organization: Ministry of Environment, Ontario, Canada

FOSSIL FUEL COMBUSTION

Reference #5

Facility Location: Sweden
Incinerator Characteristic: (1) Oil-fired boiler w/o ESP, (1) Pulverized Coal-fired boiler w/ESP
Sampling Schedule/# of Samples: 3 tests oil boiler before ESP
3 tests coal boiler after ESP
Samples 1,2,3 = Oil; Samples 11,12,13 = PC
Extraction: Soxhlet
Analysis Technique: GC/MS
Precursors Present: Oil or Coal
Sampling Organization: N/A

Reference #59

Facility Location: N/A
Incinerator Characteristic: One Plant
Sampling Schedule/# of Samples: 1 Sample
Extraction: Basic Extraction
Analysis Technique: GC/MS
Precursors Present: Coal
Sampling Organization: Batelle, Columbus Labs

Reference #62

Facility Location: Midland, Michigan, U.S.A.
Incinerator Characteristic: Powerhouse
Sampling Schedule/# of Samples: N/A
Extraction: N/A
Analysis Technique: 2 samples tested using GC/MS
3 samples tested using electron capture GC
Precursors Present: Coal and Oil
Sampling Organization: Dow Chemical

Reference #93

Facility Location: (7) Coal-Fired Utility Plants
Incinerator Characteristic: Large pulverized coal-fired boiler
Sampling Schedule/# of Samples: 5 days
Extraction: Soxhlet/Benzene
Analysis Technique: HRGC/MS
Precursors Present: Coal
Sampling Organization: Midwest Research Institute

Reference #97

Facility Location: U.S.
Incinerator Characteristic: 7 Coal-fired power plants
Sampling Schedule/# of Samples: 7 Samples
Extraction: Soxhlet/Benzene (24 hr)
Analysis Technique: GC/MS
Precursors Present: Coal
Sampling Organization: U.S. EPA

Reference #125

Facility Location: N/A
Incinerator Characteristic: One Plant
Sampling Schedule/# of Samples: N/A
Extraction: Hexane/Acetone
Analysis Technique: GC/MS
Precursors Present: Low Sulfur Coal
Sampling Organization: University of California at Davis, U.S.A

WOOD COMBUSTION

Reference #6

Facility Location: Pilot Scale Incinerator
Incinerator Characteristic: Treated Wood
Sampling Schedule/# of Samples: 5 Trials; A = Trichlorophenate
B = Tetrachlorophenate
Extraction: N/A
Analysis Technique: N/A
Precursors Present: Tetrachlorophenolate, trichlorophenolate
Sampling Organization: Swedish Water and Air Pollution Research Institute

Reference #7

Facility Location: N/A
Incinerator Characteristic: Open Fire/Treated Wood
Sampling Schedule/# of Samples: 8 Experiments
Extraction: Basic
Analysis Technique: GC/MS
Precursors Present: 2,4,5-T
Sampling Organization: Swedish Water and Air Pollution Research Institute

Reference #54

Facility Location: U.S.A. (6 Sites, Eastern Region)
Incinerator Characteristic: Residential woodstoves
Sampling Schedule/# of Samples: N/A
Extraction: Benzene
Analysis Technique: HRGC/LRMS
Precursors Present: Wood
Sampling Organization: Dow Chemical

Reference #62

Facility Location: U.S.A.
Incinerator Characteristic: 1 25 yr. old fireplace tested
1 12 yr. old fireplace tested
1 natural gas furnace tested
Sampling Schedule/# of Samples: N/A
Extraction: N/A
Analysis Technique: GC/MS
Precursors Present: Fireplaces - wood was burned
Natural Gas Furnaces - natural gas was burned
Sampling Organization: Dow Chemical

Reference #165

Facility Location: U.S.A. (NH, MN, MI, OR)
Incinerator Characteristic: Residential wood combustion
Sampling Schedule/# of Samples: NH, 6; MN, 5; MI, 1; OR, 6 (6/region)
Extraction: Benzene/Soxhlet
Analysis Technique: HRGC/MS
Precursors Present: Residential wood
Sampling Organization: Dow Chemical

Reference #167

Facility Location: 1 site tested in Cape Cod, MA
1 site tested in Midland, MI
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: N/A
Extraction: N/A
Analysis Technique: GC/MS
Precursors Present: 4 samples from Cape Cod burned oil
4 samples from Cape Cod burned wood
5 samples from Midland burned oil & wood
Sampling Organization: Dow Chemical

Reference #179

Facility Location: N/A
Incinerator Characteristic: Fluidized Bed, 100 kg/hr
Sampling Schedule/# of Samples: N/A
Extraction: N/A
Analysis Technique: GC/MS
Precursors Present: PCP/Hypochlorite
Sampling Organization: University of Amsterdam

Reference #190

Facility Location: N/A
Incinerator Characteristic: Chlorophenate Pyrolysis
Sampling Schedule/# of Samples: N/A
Extraction: Soxhlet/Methylene Chloride
Analysis Technique: GC/MS
Precursors Present: Servarex/Birch leaves, Servarex/wood wool, Kymmene (KY-5)/Birch leaves, Pentachlorophenate, 2,4,6-Trichlorophenate
Sampling Organization: University of Umea, Sweden

Reference #233

Facility Location: Tooele Army Depot
Incinerator Characteristic: Contaminated Waste Processor, Small,
Feed loading = 400 lb/hr
Sampling Schedule/# of Samples: 5 hours
Extraction: Soxhlet/Benzene
Analysis Technique: GC/MS
Precursors Present: PCP-coated ammunition boxes, explosive contaminated waste, PCP-coated wood, ammunition boxes
Sampling Organization: N/A

BOILERS COFIRING WASTES

Reference #33

Facility Location: Aargu, Switzerland
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: N/A
Extraction: Methylene Chloride
Analysis Technique: GC/MS
Precursors Present: Used Industrial Oil
Sampling Organization: Swiss Federal Research Station

Reference #40

Facility Location: Site Identification:
A = Woodfired Stoker
D_1 = Watertube Boiler (No. 6 Oil)
D_2 = Watertube Boiler (No. 6 Oil)
E = Package single burner watertube (No. 6 Oil)
H = Pulverized coal fired boiler
L = Package single burner watertube (Nat. Gas)
Incinerator Characteristic: See Above
Sampling Schedule/# of Samples: A = 4 tests
D = 3 tests
E = 6 tests
H = 3 tests
L = 1 test
Extraction: Soxhlet
Analysis Technique: HRGC/HRMS
Precursors Present: Creosote sludge, carbon tetrachloride, chlorobenzene, trichloroethylene, methanol, toluene, Bis (2-chloroethyl) ether, tetrachloroethylene.
Sampling Organization: Acurex Corporation

Reference #41

Facility Location: 1 was tested at Site A
1 was tested at Site D
1 was tested at Site E
and 1 was tested at Site G
Incinerator Characteristic: Site A = Keeler CP Steam Generator
Site D = B&W Wall - Fired Boiler
Site E = Watertube Boiler, A Type
Site G = Firetube Boiler, Modified 3 pass wet back Scotch Marine
Sampling Schedule/# of Samples: Site A = 4 tests; All Others = N/A
Extraction: Soxhlet Methylene Chloride
Analysis Technique: HRGC/HRMS
Precursors Present: Site A = Waste Wood/Creosote sludge
Site D = CL-Solvents
Site E = CL-Waste Oil
Site G = CL-Wastes
Sampling Organization: Acurex Corporation

Reference #57

Facility Location: N/A
Incinerator Characteristic: Industrial Boiler (pile burner)
Sampling Schedule/# of Samples: 5 days
Extraction: N/A
Analysis Technique: GC/MS
Precursors Present: PCP/scrap wood
Sampling Organization: Acurex Corporation

Reference #62

Facility Location: Midland, Michigan
Incinerator Characteristic: Rotary Kiln with and without supplemental fuel, Tarburner, 72 MM Btu/hr with natural gas as supplemental fuel
Sampling Schedule/# of Samples: TB = Tarburner; RK = Rotary Kiln
Extraction: N/A
Analysis Technique: GC/MS
Precursors Present: GAS, SW, Tars, Natural gas
Sampling Organization: Dow Chemical

Reference #81

Facility Location: Greenhouse, Office Building, U.S.A.
Incinerator Characteristic: Site A = Cast Iron
Site C = Horizontal Return Tube
Site D = Scotch Firetube 3 Pass
Site E = Scotch Firetube 4 Pass
Site F = Scotch Firetube 3 Pass
Site G = Scotch Firetube 4 Pass
Sampling Schedule/# of Samples: A = 5 tests
C = 2 tests
D = 5 tests
E = 5 tests
F = 5 tests
G = 3 tests
Extraction: Soxhlet/Methylene Chloride
Analysis Technique: GC/MS
Precursors Present: Spiked Waste Oil
Sampling Organization: EPA/GCA Corporation

Reference #95

Facility Location: Bay City, Michigan, U.S.A.
Incinerator Characteristic: High Efficiency Industrial Boiler
Sampling Schedule/# of Samples: 3
Extraction: Soxhlet/Methylene Chloride
Analysis Technique: GC/MS
Precursors Present: PCBs (500 ppm)
Sampling Organization: GCA Corporation

Reference #96

Facility Location: Northeast Utility Boiler
Incinerator Characteristic: 10% Waste Oil
Sampling Schedule/# of Samples: 3 days
Extraction: Soxhlet/Hexane
Analysis Technique: GC/MS
Precursors Present: PCB Waste Oil
Sampling Organization: GCA Corporation

Reference #193

Facility Location: Europe
Incinerator Characteristic: Industrial Boiler (PCP Wastes)
Sampling Schedule/# of Samples: N/A
Extraction: Soxhlet/Toluene
Analysis Technique: GC/MS
Precursors Present: PCP
Sampling Organization: University of Umea, Sweden

HAZARDOUS WASTE INCINERATORS

Reference #2

Facility Location: M/T Vulcanus
Incinerator Characteristic: 1600 C, RT = 1.35 (8/82)
Sampling Schedule/# of Samples: 10 tests/3 days
Extraction: Soxhlet/Hexane
Analysis Technique: GC/HRMS
Precursors Present: PCB - Contaminated Waste
Sampling Organization: TRW, Inc.

Reference #3

Facility Location: M/T Vulcanus
Incinerator Characteristic: Incinerator Ship
Sampling Schedule/# of Samples: 13 days/6 weeks
Extraction: Basic Extraction
Analysis Technique: GC/MS
Precursors Present: Herbicide Orange
Sampling Organization: TRW, Inc.

Reference #21

Facility Location: N/A
Incinerator Characteristic: Rotary Kiln (>1000°C)
Sampling Schedule/# of Samples: N/A
Extraction: Soxhlet/Benzene
Analysis Technique: GC/MS
Precursors Present: Chlorine-containing industrial wastes
Sampling Organization: Untersuchungs Laboratorium, Federal Republic of Germany

Reference #88

Facility Location: South Chicago, IL
Incinerator Characteristic: Rotary Kilns, Incin. Temp. (1200°C)
Sampling Schedule/# of Samples: 4 runs
Extraction: Hexane
Analysis Technique: GC/MS, GC/HRMS
Precursors Present: PCBs
Sampling Organization: Midwest Research Institute

Reference #108

Facility Location: James Denney Farm Site, McDowell, Missouri, U.S.A.
Incinerator Characteristic: Mobile Incinerator (Rotary Kiln) 1550-1750°F
Solids: 30 minutes retention
Gases: heated to 2100-2250, 2-3 sec retention
Sampling Schedule/# of Samples: Solid, liquid, gaseous samples
Extraction: Soxhlet/Benzene
Analysis Technique: GC/MS
Precursors Present: Sediment from industrial waste storage lagoon. Dioxin-contaminated liquid still bottoms & soil. Montmorillonite w/absorbed PCB's & solid hexachloroethane.
Sampling Organization: IT Corporation

Reference #136

Facility Location: J.M. Huber Corp.
Incinerator Characteristic: PCB Pyrolysis (2000 C)
Sampling Schedule/# of Samples: 4 tests
Extraction: N/A
Analysis Technique: GC/MS
Precursors Present: PCBs
Sampling Organization: Radian Corporation

Reference #153a

Facility Location: Dow Chemical/Midland, Michigan
Incinerator Characteristics: Building 703 incinerator. Rotary kiln w/afterburner
Sampling Schedule/# of Samples: 3 days; A = 8/28/84; B = 8/30/84
C = 9/5/84
Extraction: N/A
Analysis Technique: N/A
Precursors Present: N/A
Sampling Organization: GCA Corporation

Reference #161

Facility Location: 1 site tested at American Cyanamid, WV
1 site tested at Abco, SC
1 site tested at DuPont, LA
1 site tested at Mitchell, NC
1 site tested at Ross, OH
1 site tested at Upjohn, TX
Incinerator Characteristic: American Cyanamid, 2 chambers
Abco, 2-Stage boiler
DuPont, Rotary kiln/Liquid injection
Mitchell, Liquid injection
Ross, Rotary kiln
Upjohn, Horizontal Cylinder Thermal Oxidizer
Sampling Schedule/# of Samples: A = Liquid Injection
B = Rotary Kiln/Liquid Injection
C = Horizontal Cylinder Thermal Oxidizer
D = Rotary Kiln
E = 2 Chambers
F = 2 Stage Boiler
Extraction: Soxhlet/Methylene Chloride
Analysis Technique: GC/MS
Precursors Present: American Cyanimid, Analine waste (0.15% Cl)
Abco, Liq Org (.4-6.6% Cl)
DuPont, Liq/Sol (0.05-16% Cl)
Mitchell, Liq Org (.4-1% Cl)
Ross, Liq Org (.02-6.2% Cl)
Upjohn, Liq/Gaseous (21% Cl)
Sampling Organization: Midwest Research Institute

Reference #162

Facility Location: Midwest Research Institute
Incinerator Characteristic: 0.8 residence time, 675°C combustion temp.,
Bench scale thermal destruction system
8% oxygen
Sampling Schedule/# of Samples: 22 tests/60 minutes
Extraction: Soxhlet
Analysis Technique: HRGS/EIMS
Precursors Present: PCBs in mineral oil (tests 1, 2, 5, 6, 9-12)
PCBs in silicone oil (tests 3, 4, 7, 8, 13, 14, 15)
Sampling Organization: Midwest Research Institute

Reference #194

Facility Location: Incinerator, Eksjo, Sweden; Industrial Boiler, USA;
Rotary Cement Kiln, Slemmestad, Norway
Incinerator Characteristic: Fluidized bed municipal incinerator/700°C,
2 sec. retention
Rotary Cement Kiln, 2000°C in flames
Sampling Schedule/# of Samples: Extracts of condensates & particulates
2 sampling periods
Extraction: Soxhlet/Toluene
Analysis Technique: GC/MS
Precursors Present: PCB's, Penta-CP waste
Sampling Organization: N/A

Reference #220

Facility Location: Los Alamos Pilot Study
Incinerator Characteristic: Controlled Air Incineration (1370°C)
Sampling Schedule/# of Samples: N/A
Extraction: Soxhlet/Toluene
Analysis Technique: GC/MS
Precursors Present: PCP-treated wood
Sampling Organization: Los Alamos National Laboratory

Reference #234

Facility Location: 1 site tested at Rollins, Deer Park, TX
1 site tested at Ensco, El Dorado, AR
Incinerator Characteristic: Rotary kiln with Afterburner (1200°C)
Sampling Schedule/# of Samples: 4 hours
Extraction: Soxhlet/Benzene
Analysis Technique: GC/HRMS
Precursors Present: 3 samples; PCB's plus fuel oil
4 samples; Waste chemicals plus PCB's
4 samples; Waste chemicals
Sampling Organization: TRW/Wright State University

Reference #246

Facility Location: New Jersey
Incinerator Characteristic: Rotary Kiln (1200°)
Sampling Schedule/# of Samples: 3 runs
Extraction: N/A
Analysis Technique: GC/MS
Precursors Present: Silvex Herbicide
Sampling Organization: Roy F. Weston

LIME/CEMENT KILNS

Reference #20a

Facility Location: General Portland, Inc., Paulding, Ohio
Incinerator Characteristic: Wet-Process Cement Kiln w/ESP for Emission Control
Sampling Schedule/# of Samples: 9 day test program
Extraction: N/A
Analysis Technique: N/A
Precursors Present: Coal and waste fuel (toluene, xylene), 2% chloride waste, 5% chloride waste (freon 113, spiked).
Sampling Organization: RTI, Engineering-Science

Reference #20b

Facility Location: Oglesby, Illinois
Incinerator Characteristic: Dry-Process Cement Kiln
Sampling Schedule/# of Samples: 6 day test program
Extraction: N/A
Analysis Technique: GC/MS
Precursors Present: Coal/coke, hydrocarbon solvents, resins and solids typical of paint wastes, freon 113 (spiked).
Sampling Organization: RTI, Engineering-Science

Reference #58a

Facility Location: Rockwood, Wisconsin USA
Incinerator Characteristic: Lime Kiln: Horizontal Rotary Kiln
Sampling Schedule/# of Samples: 2 Runs/baghouse dust
3 Runs/EPA Method 5 filters
Extraction Technique: GC/MS
Precursors Present: Petroleum coke and waste fuel (laquer thinner solvents, alcohols, still bottoms, paint wastes)
Sampling Organization: Monsanto Research Corporation

Reference 184

Facility Location: San Juan Cement, Puerto Rico
Incinerator Characteristic: 1260 C, RT = 1.5 sec
Sampling Schedule/# of Samples: 4 Samples
Extraction: Soxhlet/Benzene
Analysis Technique: GC/MS
Precursors Present: Pharm. Wastes (21% Cl)
Sampling Organization: Monsanto Research Corp.

HOSPITAL INCINERATORS

Reference #62a

Facility Location: USA, Canada
Incinerator Characteristic: Canada--Controlled-air, two chamber incinerator, 800 Kg/hr.
USA--3 Controlled-air incinerators;
#1 w/scrubber, 400 lb/hr, 1750°F
#2 w/waste heat boiler, 730 lb/hr, 1950°F
#3 w/waste heat boiler, 1150 lb/hr, 1700°F
Sampling Schedule/# of Samples: Canada: 4 tests
USA: 3 stack test filter samples
Extraction: Canada--N/A; USA--EPA Method 5 filters
Analysis Technique: Canada--N/A; USA--GC/MS
Precursors Present: Canada--mixed hospital wastes; USA--#1 infectious waste; #2 general hospital waste; #3 general hospital waste
Sampling Organization: Canada--Environment Canada; USA--Midwest Research Laboratories

Reference #31a

Facility Location: Victoria, British Columbia, Canada
Incinerator Characteristic: Controlled air, two chamber incinerator, 800 Kg/hr.
Sampling Schedule/# of Samples: 4 tests
Extraction: Soxhlet/benzene
Analysis Technique:
Precursors Present: Mixed hospital wastes
Sampling Organization: Ministry of the Environment, Ontario, Canada

WIRE RECLAMATION INCINERATOR

Reference #103

Facility Location: Midwestern USA
Incinerator Characteristic: 3 incinerators
Sampling Schedule/# of Samples: N/A
Extraction: Hexane/Acetone
Analysis Technique: GC/MS
Precursors Present: Wire Insulation
Sampling Organization: U.S. EPA

PCB FIRES

Reference #60

Facility Location: Boston, U.S.A.
Incinerator Characteristic: Electrical fire involving PCB's
Sampling Schedule/# of Samples: One bulk soot sample
Extraction: N/A
Analysis Technique: N/A
Precursors Present: PCB
Sampling Organization: N/A

Reference #76

Facility Location: Surrahammar, Sweden
Incinerator Characteristic: 500 unit capacitor battery filled with PCB's
Sampling Schedule/# of Samples: 10 samples
Extraction: N/A
Analysis Technique: N/A
Precursors Present: PCB's
Sampling Organization: N/A

Reference #98

Facility Location: New York, U.S.A.
Incinerator Characteristic: Electrical fire
Sampling Schedule/# of Samples: N/A
Extraction: N/A
Analysis Technique: N/A
Precursors Present: PCBs
Sampling Organization: N.Y. State Department of Health

Reference #99

Facility Location: Miami, Florida, U.S.A.
Incinerator Characteristic: Electrical fire involving PCB's
Sampling Schedule/# of Samples: Bulk soot samples, surface wipe samples
Extraction: Hot Benzene
Analysis Technique: HRGC/MS
Precursors Present: PCB's
Sampling Organization: U.S. National Institute of Occupational Safety and Health

Reference #110

Facility Location: Stockholm, Sweden
Incinerator Characteristic: Transformer station electrical fire
Sampling Schedule/# of Samples: N/A
Extraction: Hexane
Analysis Technique: GC/MS
Precursors Present: PCBs
Sampling Organization: National Swedish Environmental Protection Board

Reference #158

Facility Location: San Francisco, California, U.S.A.
Incinerator Characteristic: PCB transformer electrical fire
Sampling Schedule/# of Samples: N/A
Extraction: N/A
Analysis Technique: N/A
Precursors Present: PCBs
Sampling Organization: N/A

Reference #192

Facility Location: Skoude, Sweden
Incinerator Characteristic: Capacitor Battery Fire
Sampling Schedule/# of Samples: N/A
Extraction: N/A
Analysis Technique: HRGC/MS
Precursors Present: PCBs
Sampling Organization: University of Umea, Sweden

Reference #215

Facility Location: Binghamton, New York, U.S.A.
Incinerator Characteristic: PCB transformer electrical fire
Sampling Schedule/# of Samples: 2 floors, 2 repli.
Extraction: Soxhlet/Benzene
Analysis Technique: GC/MS
Precursors Present: PCBs, Chlor. Benzene
Sampling Organization: N.Y. State Department of Health

Reference #218

Facility Location: Karl Site, Chehalis, Washington, U.S.A.
Incinerator Characteristic: Open fire
Sampling Schedule/# of Samples: N/A
Extraction: Toluene Soxhlet
Analysis Technique: N/A
Precursors Present: Transformer oil and cores
Sampling Organization: Washington State Department of Ecology

AUTOMOBILE EMISSIONS

Reference #62

Facility Location: Pontiac, Michigan, U.S.A.
Detroit, Michigan, U.S.A.
Auburn, Michigan, U.S.A.
Saginaw, Michigan, U.S.A.
Incinerator Characteristic: Pontiac = Reg. Gas/No Catalytic Convertor (1)
Detroit = Unleaded/Catalytic Convertor (1)
Unleaded/Catalytic Convertor/Low/Mileage (1)
Auburn = Diesel Truck (1)
Saginaw = Diesel Truck (1)
Sampling Schedule/# of Samples: 1 = Reg. Gas/No Catalyst
2 = Unleaded/Catalyst/Low Mileage
5 = Unleaded/Catalyst
6 = Diesel Truck (Saginaw)
7 = Diesel Truck (Auburn)
Extraction: N/A
Analysis Technique: GC/MS
Precursors Present: Pontiac = Regular Gas
Detroit = Unleaded Gas
Auburn = Diesel Fuel
Saginaw = Diesel Fuel
Sampling Organization: Dow Chemical

Reference #213

Facility Location: N/A
Incinerator Characteristic: Diesel
Unleaded
Leaded
Chevette-Broken Ring
Sampling Schedule/# of Samples: Diesel = 2 Cars
Unleaded/Catalyst = 10 Cars
Leaded = 3 Cars
Chevette-Broken Ring = 1 Car
W_1 = Diesel
W_2 = Leaded Gas
W_3 = Unleaded Gas
W_4 = Unleaded Gas (Chevette)
Extraction: Methylene Chloride/Hexane
Analysis Technique: HRGC/HRMS
Precursors Present: 4 Diesel Fuel
2 Unleaded Gas
2 Leaded Gas
Sampling Organization: U.S. EPA

THERMAL ACTIVATED CARBON REGENERATION

Reference #13

Facility Location: Cincinnati Waterworks, Ohio, U.S.A.
Incinerator Characteristic: Incinerator temp = 1000°C, Fluidized Bed (1500°F)
Sampling Schedule/# of Samples: 1-2 hours; 4 tests
Extraction: Soxhlet/Benzene
Analysis Technique: HRGC/HRMS
Precursors Present: Activated Carbon
Sampling Organization: Battelle Columbus Laboratories

Reference #156

Facility Location: Cincinnati Waterworks, Ohio, USA
Incinerator Characteristic: Carbon Regeneration
Sampling Schedule/# of Samples: 4 recuperator; 3 afterburner; 2 stack
Extraction: Soxhlet/Benzene
Analysis Technique: HRGC/HRMS
Precursors Present: Activated Carbon
Sampling Organization: Battelle Columbus Laboratories

EXPERIMENTAL

Reference #34

Facility Location: Quartz Mini Ampoules
Incinerator Characteristic: Trichlorobenzene Pyrolysis
Sampling Schedule/# of Samples: N/A
Extraction: Benzene
Analysis Technique: GC/MS
Precursors Present: Tri-, Tetra-, and Pentachlorobenzene
Sampling Organization: Swiss Federal Research Station

Reference #36

Facility Location: Quartz Mini Ampoules
Incinerator Characteristic: PCB Pyrolysis (550°C, 600°C, 650°C, 700°C, 850°C)
Sampling Schedule/# of Samples: A = Arochlor 1254
B = 2,4,6,2',4',5'-Hexachlorobiphenyl
C = 2,4,5,2,4',5'-Hexachlorobiphenyl
Extraction: Benzene/Hexane
Analysis Technique: GC/MS
Precursors Present: Arochlor 1254, 2,4,6,2',4',5' Hexachlorobiphenyl
Sampling Organization: Swiss Federal Research Station

Reference #37

Facility Location: Quartz Mini Ampoules
Incinerator Characteristic: PCB Pyrolysis, 600°C
Sampling Schedule/# of Samples: N/A
Extraction: Benzene
Analysis Technique: GC/MS
Precursors Present: 18 PCB isomers
Sampling Organization: Swiss Federal Research Station

Reference #62

Facility Location: N/A
Incinerator Characteristic: Cigarette Smoke
Sampling Schedule/# of Samples: 2 Tests
Extraction: Hexane
Analysis Technique: GC/MS
Precursors Present: Tobacco
Sampling Organization: Dow Chemical

Reference #111

Facility Location: Pilot Incineration
Incinerator Characteristic: Chlorophenol-Treated Wood
Sampling Schedule/# of Samples: 5 Tests
Extraction: Soxhlet/Benzene
Analysis Technique: Mass Frag.
Precursors Present: Na Tetrachlorophenol, Pentachlurophenol, K trichlorophenol, Pentachlorophenol, tetrachlorophenolate
Sampling Organization: University of Stockholm, Sweden

Reference #145

Facility Location: N/A
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: Mimosa, fruit/vegetables, chestnuts, all vegetables tested
Extraction: N/A
Analysis Technique: GC/MS
Precursors Present: Vegetables + Cl, Vegetables only
Sampling Organization: Universita Roma, Italy

Reference #146

Facility Location: N/A
Incinerator Characteristic: 500-600°C, Quartz mini ampoule, chlorophenol pyrolysis
Sampling Schedule/# of Samples: N/A
Extraction: Benzene
Analysis Technique: GC/MS
Precursors Present: PCP/Hypochlorite
Sampling Organization: University of Umea, Sweden

Reference #149

Facility Location: N/A
Incinerator Characteristic: Quartz Tube
Sampling Schedule/# of Samples:
1 = Feed/HCl
2 = Feed Coal
3 = Cl_2 + Air
4 = Coal + Air
5 = Coal + Air + NaCl
6 = Coal + Air + HCl
7 = Coal + Air + Cl_2
Extraction: Soxhlet/Benzene
Analysis Technique: GC/MS
Precursors Present: Coal, NaCl, HCl, Cl_2
Sampling Organization: Dow Chemical

Reference #200

Facility Location: N/A
Incinerator Characteristic: 700C/15 sec, 900C/35 sec, 700C/0.5 sec, 900C/.67 sec, 700C/.7 sec, 900C/3.4 sec, 900C/1.6 sec, 250C
Sampling Schedule/# of Samples: N/A
Extraction: Trisodium Phosphate
Analysis Technique: GC/MS
Precursors Present: 2,4,5-TCP, Alchem 4135, Diptank sludge, Wood Brite 24
Sampling Organization: Environment Canada/Dearborn Environmental Services

Reference #219

Facility Location: N/A
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: 6 Trials
Extraction: Benzene/Methanol
Analysis Technique: GC/MS
Precursors Present: 2,4,5-Trichlorophenoxy
Sampling Organization: Dow Chemical

Reference #226

Facility Location: Quartz Tube
Incinerator Characteristic: N/A
Sampling Schedule/# of Samples: N/A
Extraction: N/A
Analysis Technique: GC/MS
Precursors Present: Pine and HCl
Sampling Organization: Wright State University